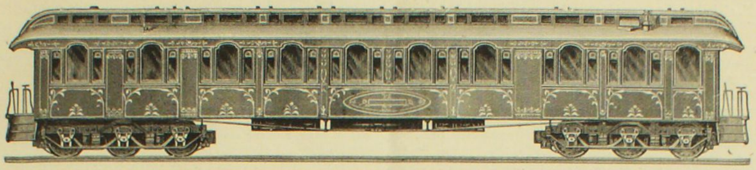
NATIONAL CAR AND LOCOMOTIVE BUILDER.



VOLUME XVIII. NUMBER 2. | FEBRUARY, 1887. | SINGLE NUMBERS, TEN CENTS, $1.00 PER ANNUM.

Miscellaneous Items.

THE Chicago, Milwaukee & St. Paul Railroad are going to erect fine new shops for locomotive and car repairs at Austin, Minn.

MR. M. G. HOWE, receiver of the Houston, East & West Texas Railway, says that all the additions made to the property during the year has been the purchase of 55 box csrs.

THE Chicago & Northwestern Railway have lately applied twelve Cooke & Strong bell-ringers to their locomotives, and the men are reported to be highly pleased with them.

MR. J. W. GREEN, general manager Georgia Railroad Company, writes us : We laid 1,000 tons of steel during the past year. We have purchased six locomotives and built in our own shops a few flat cars.

MR. J. H. P. HUGHART, assistant to the president of the Grand Rapids & Indiana Railroad, informs us that during last year the company built 40 miles of road, and have purchased 6 locomotives and 1,000 freight cars.

LAST year's improvements on the property of the Detroit Mackinac & Marquette Railroad, as reported to us by Mr. A. Watson, general superintendent, consisted of 10 miles of track ballasted, and 600 tons of steel put down to replace iron rails.

THE general manager of the Elmira, Cortlandt & Northern, writes us that during the last year they have completely relaid their track with steel rails, erected a new engine house at Cortlandt, bought two consolidation locomotives and three moguls.

MR. H. W. DUNNE, superintendent of the New York, Philadelphia & Norfolk, informs us that during the last year his company have built two miles of new sidings, ballasted ten miles of track, built a new freight house at Richmond, Va., and purchased three new locomotives.

MR. GEO. H. NETTLETON, general manager Kansas City, Fort Scott & Gulf, informs us that during the past year they have laid 5 miles of 60 pound steel rails and ballasted 30 miles of track. They are building a new passenger depot at Fort Scott which will cost about $25,000. The work in their shops has been confined to repairs.

MR. T. P. SHOUTS, general manager Indiana, Illinois & Iowa Railroad, writes us : We have extended our lines from North Judson to Knox, and have built a new depot at the latter place. We have erected a new coal shed at North Judson and one at Streator. Have built an addition to our roundhouse at Kankakee and bought four new engines.

MR. I. BURGOON, receiver of the Bellaire, Zanesville & Cincinnati Railway, writes : Have relaid seven miles of track with new steel, erected brick repair shops, 43 × 103 feet, at Zanesville, with brick blacksmith shop, 25 × 45 feet, attached, and put in the necessary machinery and tools. Have purchased 2 coaches, 1 caboose, 26 box cars, and 50 coal cars.

FOR some years past there has been a severe conflict going on in China among parties representing British, American and German interests respectively, in the attempt to secure the right to build railroads. The British appear to be worsting the others, for an English firm has obtained permission to construct a railroad between Tamsui and Keelung.

MR. WM. ROGERS, general manager Central & Southwestern Railroads of Georgia, writes us : We have laid 350 tons of 56 pound steel rails during the year, on Savannah & Griffin Div., and 440 tons of the same kind of rails on the Atlanta & Savannah Div. Have built two brick warehouses and purchased 2 locomotives, 4 passenger coaches and 50 open cars.

THE Pennsylvania Railroad are building a new dynamometer car with machinery for recording the draw-bar tension designed after the Emery testing machine. The intention is to keep a continuous diagram of the action of the steam in the cylinders of any locomotive under investigation. We reckon the latter will be an exceedingly difficult operation to carry out.

FROM Mr. R. H. Soule, New York, Lake Erie & Western, we learn that during the last year they have received two new Wootten mogul passenger engines from the Baldwin Locomotive Works, and eight Wootten consolidation engines. The N. Y., P. & O. portion of the road has received fifteen bituminous coal-burning locomotives, five of them having been built at the Susquehanna shops.

MR. WILLIAM WILSON, Chicago, Alton & St. Louis, writes : We have built during the year six new locomotives. Four of them are of our class A and two of class C. Class A is the standard passenger engine and class C switchers. Two of the engines built are of the former class, except that they have my valve gear operating single valve. One has the gear operating double valves.

MR. C. W. SMITH, general manager of the Atchison, Topeka & Santa Fe Railroad, writes us : We have added to our rolling stock equipment 7 emigrant sleepers, 20 first-class coaches and 1,000 freight cars. We have built two locomotives in our own shops. Four new passenger engines have been purchased from the Baldwin Locomotive Works, and two switching engines from the Schenectady Locomotive Works.

THE Cincinnati, New Orleans & Texas Pacific road reports the following items of construction on main and associated lines during the past year : Iron rails replaced with 60 pound steel rails, 112 miles; new sidings, 20 miles; tunnel arching, 2,100 lin. ft.; new iron bridges, 189 lin. ft.; extending wood bridges, 1,180 lin. ft.; new depots 8 ; new locomotives, 4 ; one 50,000-gallon tank ; and 3 new coaches.

FROM Mr. C. J. Ives, President of the Burlington, Cedar Rapids & Northern Railway, we learn that last year they built 42.6 miles of new track and replaced 12 pile bridges with stone culverts. They have replaced 22 miles of light steel with heavy steel rails and put the light rails on branches. They built three new round-houses, all of them being of brick, put up in first-class style, with all advanced improvements.

MR. S. CONANT, general manager of the Florida Southern Railway, writes : We have constructed 75 miles additional road during the year. Have erected 5,000 feet of dock at Punta Gorda, with first-class warehouses, furnishing the only deep water connection on the Florida coast outside of Pensacola for vessels doing business on the Gulf. Also erected a hotel at Punta Gorda. Bought 12 new locomotives, 100 box cars and 50 flats.

AN analysis of the Northern Pacific Railroad performance sheet for October last, shows that the passenger engines did their work with a coal consumption of 46 38 miles to the ton, or about 43 pounds per engine mile. This is exceedingly good work, especially when the facts are considered that the road contains numerous heavy grades, that a considerable proportion of the coal is of inferior quality, and that the trains are all heavy.

WE learn from Mr. Jas. L. Frazier, superintendent of the Western division of the Newport News & Mississippi Valley Co., that during the last year they have laid 7,000 tons of steel rails in the track between Louisville and Memphis. They have erected a large union depot passenger shed, 150 × 300 feet, with waiting rooms, office, etc., centrally located in Louisville. They have purchased and put in service 11 locomotives and 200 new cars.

WE learn from Mr. G. W. Cushing, who is superintendent of motive power of the Oregon Terminal Company, that the company's shops at Albina, Ore., will be finished within a year. The grading of the ground is now being pushed vigorously and contracts have been awarded for building the structures. The shops are very extensive, and it is expected that they will do repairing and supply finished machinery to most of the railroads in Oregon.

THE motive power added to the equipment of the Chicago, Milwaukee & St. Paul Railroad during last year, was ten 10-wheel freight engines, with cylinders 19 × 26 inches, built by the Schenectady Locomotive Works, one eight-wheel locomotive built by the Brooks Locomotive Works, and ten eight-wheel engines built by the Rhode Island Locomotive Works. Three new switching engines, with cylinders 16 × 22 inches, were built in the company's shops at Milwaukee.

THE Allegheny Valley Railroad Company write us : Our principal work during the year 1886 was improving of track and road-bed. On River and Low Grade divisions our track is now laid throughout with 60 pound steel rails, white oak ties, and rock or cinder ballast. We rebuilt several bridges during the year, and erected handsome stations at Foxburg and Pittsburgh. We expect to build and buy about 250 freight cars during 1887, and probably two engines.

MR. A. B. UNDERHILL, of the Boston & Albany, writes us : During the railroad year of 1886 we built nine locomotives, five freight, three passenger, and one switching engine. The freight and passenger were high pressure and equipped with retaining rings on driving-wheel tires, steel driving boxes, steel cross-heads, balanced valves, driver brake, metallic packing in stuffing boxes, and Bemis tender boxes. Nothing peculiar about the construction. Our standard passenger engine.

MR. ROSWELL MILLER, general manager of the Chicago, Milwaukee & St. Paul Railway, writes us : We have built 422 miles of new road during the past year. We have built a large new depot here (Milwaukee) just opened, which cost $200,000, and expended in other improvements, apart from the cost of the new road just mentioned, upwards of $1,400,000. These improvements are too numerous to give in detail. During the past year we have purchased 1,500 box cars, 700 flats, 40 coaches, 1 dining car, 5 sleepers and 22 locomotives.

IN answer to a letter of inquiry, Mr. J. N. Lauder, Old Colony Railroad, says : We have built five locomotives during the past year, three with cylinders 17 × 24 inches and two 18 × 24 inches, all for passenger service. The 18 × 24 engines have my new arrangement of exhaust pipes, and they have the Dean guide. With these exceptions, there is nothing peculiar about the engines except perhaps that they have very liberal heating surface, aggregating 1,44[illegible] square feet. They are carrying 175 pounds of steam and are working finely.

FROM Mr. Charles Graham we learn that the Delaware, Lackawanna & Western built one new locomotive in each of their leading shops during the year. The engine turned out by Mr. Lewis at Kingsland, N. J., was a mogul with cylinders 19 × 24 inches, driving wheel centers 50¼ inches. An engine of the same class and dimensions was built at East Buffalo by Mr. F. B. Griffith and a mogul of the same cylinder dimensions, but with wheel centers 45 inches diameter, was built by Mr. Graham at Kingston, Pa. The latter engine has a Wootten boiler.

THE Canadian Locomotive and Engine Company, Kingston, Ont., are doing a good business in locomotive building. Mr. F. D. Child, so well known in the United States as superintendent of the Hinkley Locomotive Works, is superintendent of the Kingston works. There is now every prospect that these works will receive permanent support from Canadian railway companies. Most of the engines built yet have been the ordinary eight-wheel American type, but they have built two consolidation engines reputed to be the largest ever built in Canada.

THE Old Colony Railroad Co. are using a special form of safety-valve made by the Consolidated Safety-Valve Co. of New York, on all the steam heaters in the passenger cars of the road. It is so constructed that none of the parts will corrode, and means are taken to prevent sparks or sand from accumulating about it. Mr. J. N. Lauder, superintendent of rolling stock of the Old Colony, speaks very highly of the performance of this safety-valve, and he regards it as a sure protection from the trouble of over pressure, so often happening with heated pipes.

WE have frequently mentioned the experiments made by Mr. Stevens, general master mechanic of the Central Pacific road, in using petroleum as fuel in the furnaces of steamers used by the company. We now learn that the practice has been abandoned, owing to the difficulty experienced in keeping the furnaces tight. The furnace wore out much more rapidly with petroleum than with coal fuel. This additional source of expense, added to the high price of petroleum, made coal the cheaper fuel, and for this reason they have returned to the use of coal.

THE first passenger train run over the Chicago, Burlington & Northern from Minneapolis to Chicago, a distance of 442 miles, was made in eleven hours and fifty minutes. This was an average speed of over 36 miles an hour, but from this had to be deducted the time lost in making thirty-two stops, fourteen for stations, thirteen for cross-

ings and five for draw-bridges. This indicated remarkably fast running over a new road, and is significant of the way the permanent way is finished. There is fair prospect of the C. B. & N. claiming the broom as the fast running line of the Northwest.

REGARDING improvement of the property during the the last year, Mr. G. M. Beach, general manager of the Cleveland, Columbus, Cincinnati & Indianapolis Railway, writes us: We have put in track during the last year 6,000 tons of 65 pound steel rail. We have just completed a brick passenger depot at Delaware, O., at a cost of $10,000. We also erected at Muncie, Ind., a new standard water tank with cast iron columns, at a cost of $3,200. Have not yet determined what we shall do in the way of erecting new station buildings in current year. We have built in the past year two standard 10-wheel engines, 4 standard 4-wheel cabooses and one sample box and stock car we contracted for during last year, and are now receiving 600 thirty-four feet box cars, 25 tons capacity, and expect soon to place an order for 200 stock cars of standard capacity. We also purchased 4 standard passenger engines during the past year, and one new tire lathe for service in our shops.

MR. C. H. HUDSON, general manager East Tennessee, Virginia & Georgia Railway, writes us: During the past year our system has laid down 9,000 tons of steel; have put 150 miles of our track in permanent stone ballast; have replaced 13 wooden trusses with iron, about 1,900 lineal feet in all; have put in 1,200 feet of plate girder bridging in addition. We have under contract 7 spans and 1,500 feet of iron viaducts, 60 × 85 feet high; have erected a new freight house in Atlanta, 54 × 400 feet, with division offices attached. Have under contract and nearly finished at Macon, Ga., a new and elegant passenger station, as fine as any in the South, and are about to commence a freight house, 50 × 400 feet, at the same point. Have added to our rolling stock 5 consolidation engines, and have 5 passenger and 4 switching engines under contract, to be delivered very soon. Have added to our freight equipment 200 box cars, 50,000 pounds capacity; 5 first-class coaches and 1 baggage car have been added to our passenger equipment. At our own shops we have simply kept up repairs.

Weight of Driving Wheels and Tires.

The following letter from Mr. John Hickey, Master Mechanic of the Milwaukee, Lake Shore & Western Railway, was read at the last meeting of the Western Railway Club:

"The subject, 'Weight of Driving Wheels and Tires,' is, in my opinion, a very important one, and an intelligent discussion of the matter will without doubt attract the attention of all prominent railroad men throughout the country.

For years I have been of the opinion that the rigid weight—that is, the weight below the springs—of all our rolling stock has not received the attention that the importance of the subject demands. We have gone on increasing this weight without considering, or at least not properly considering the ultimate results, especially when in connection with this we use springs, the action of which is so rigid as to be unworthy the name of spring; or, on the contrary, the capacity of the springs is so much below the weight they are required to bear that they become solidly set under the necessary load. The latter condition of affairs exists to a deplorable extent on freight cars, and is not only destructive to the stock itself, particularly to wheels, but is particularly expensive and dangerous to the permanent way. In view of the largely increased freight car loads the matter becomes of great interest, and may be ranked equal in importance to the weight of driving wheel and tire.

"I regret I have not the figures at hand that would add some indisputable information to the subject, but I think all will agree that it is a noticeable fact, since we increased the weight of driving axles, driving boxes, rods, counterbalances, wheel centers, and tires, that the mileage per $\frac{1}{16}$ inch wear is much less than it was when these articles were made lighter; and it will be admitted that in a large majority of cases the miles per $\frac{1}{16}$ inch wear on front driving tire is less than the mileage made to the same wear on a back tire. This is caused no doubt by the increased weight of counterbalance, main connections and eccentrics necessary additional weight on front wheels.

"A few years ago while on a western road we had sent us, from an eastern manufacturer, a set of locomotive tires. Wishing to compare their wearing qualities with the tires we had in use, I kept a close record, and found they averaged 8,890 miles per $\frac{1}{16}$ inch wear before first turning. Having to bring the engine into the shop, owing to a cracked crank-pin hub, and because there were cracked spokes and other defects in some of the other wheel centers, caused by imperfect molding, another pattern was substituted. This was 400 pounds less weight than the old one, making a total reduction of 1,600 pounds in the four wheels. The amount of difference in weight of wheel centers being considered necessary for proper adhesion, it was attached by means of cast-iron slabs to the deck plate and other parts on the frame where it had the benefit of springs. The old tires were now placed on the new wheel centers, and receiving the first turning, the engine was placed in the same service she had been in prior to her advent into the shop. A record of the wear of tire after this showed that the engine ran an average of 11,257 miles to the $\frac{1}{16}$ inch wear, or 2,367 miles more than before first turning, and when she had the heavier wheel centers. Between the second and third turning the average miles to the $\frac{1}{16}$ inch wear was over 1,600 miles more than made before first turning.

"You will see from this that the lowest mileage per $\frac{1}{16}$ inch wear was made by a part of the tire where the highest mileage was to be expected, and that no change was made other than a reduction in the weight of wheel center, together with the amount taken off the tire, to true it up at its first turning.

"I do not claim for a certainty that the greater mileage was obtained through the reduction of weight of wheels and tire, but it looks as if that was at least partly responsible for it.

"It is unnecessary for me to say here that the men having control of the throttle have much to do with the wear of locomotive tires. The use of sand, and the abuse by slipping, as well as rigid weight, adds to abrasion, and some engineers are more careless than others.

"There can be no question but the rigid weight of rolling stock is much more destructive to track than if such weight were cushioned by the intervention of proper springs. When it is considered that keeping the permanent way in serviceable condition is the greatest difficulty met with in railway operating, and that one of the most important subjects before railroad managers at present is how to get paying freight over the road with the least injury to track, the importance of this subject can be realized. A thoughtful discussion of the matter, and practical conclusions reached may therefore be of vast consequence to railway interests.

"If some of our scientific friends would turn their attention to the solution of this important subject, they would serve a more profitable purpose and perhaps arrive at a nearer solution of a practical problem, than by racking their brains in writing pages of labored effort trying to solve the mysteries of the 'hammer blow.'"

Minnesota & Northwestern Railroad.

Mr. Raymond du Puy, Superintendent of this road, writes us:

In regard to additions or improvements made on our permanent road, we have built and completed 172 miles of track between Hayfield, Minn., and Dubuque, Ia. The road is laid with 60-pound steel rail, 3,000 ties to the mile, ballasted throughout with an average of a foot of ballast, has both passing and house tracks on an average of six miles apart, stations of a new and improved design every six miles, averaging in size 22 × 60 feet. The passing tracks are all 2,000 feet long between head-blocks, and the house tracks 1,000 feet long. We have also bought the Dubuque & Dakota Railroad, extending from Sumner, Ia., to Hampton, Ia., a distance of 62 miles. This road was, when purchased, in very fair condition, and as yet no improvements have been made on it except the building of a handsome station at Waverly, Ia. In addition to this, we have up to the present date laid 72 miles of track on our Chicago division, extending from Chicago west to Freeport; 100 miles of this track will be finished during January, and the balance of about 60 miles will be completed this summer and the track ballasted, stations built and the line put in first-class shape for us sometime in October. The contract has also been let for the extension of our road from Des Moines to Kansas City, which will be done this coming year.

In regard to rolling stock, this company has contracted with the Barney & Smith Mfg. Co. for the following equipment in addition to what we now have: Twenty first-class sleeping cars, 20 parlor cars, 20 day coaches, 10 combination smoking and baggage cars, 4 mail and express cars and 4 dining cars. All these cars will be somewhat on the pattern of the new Canadian Pacific equipment, which I believe is considered the handsomest turned out, and will be of solid mahogany finish throughout, with no paint on the outside. The company has bought 20 new locomotives of its standard size, 17 × 24 inch cylinders, in the year 1886, and has contracted for 40 locomotives for early delivery in 1887. Twelve of these new locomotives are for passenger service exclusively, cylinders 19 × 24 inches, driving wheels 5 ft. 10 in., and will weigh in complete working order 100,000 pounds. They are being built by the Cook Locomotive and Machine Company of Paterson, N. J.

The company has also bought in the year 1886, about 1,500 box and stock cars of its standard, 33 ft. in length, and has contracted for delivery in 1887, 2,500 additional box, 300 stock and 200 flat cars, which will bring our average equipment up to about six freight cars per mile. We have also contracted with the Haskell & Barker Car Co. for 36 new cabooses to be delivered in 1887. I trust that these few facts which I have given you from memory will prove to be the information you desire.

Pittsburgh Locomotive Works.

Like all other first-class locomotive builders, these shops are very busy and are turning out about two engines a week. They have an order of Baltimore & Ohio moguls on hand which gives a large proportion more work than ordinary locomotives of the same class. For the force employed, and considering the room occupied, these works have the means of turning out a very large quantity of finished work. They have carried the system of employing special tools for duplicating processes with exactness to great perfection. The methods so much used in armories, sewing machine factories and other places where smal-metal work is duplicated by jigs, peculiarly shaped milling cutters and other special appliances, is here extended to heavy locomotive work with the most satisfactory results. There is scarcely a small form or piece used in machinery that eastern shops do not produce milling cutters for finishing without hand work, and it seems that only a little ingenuity is necessary to apply the same system to the large forms of locomotive details. This appears also to have been the opinion of Mr. D. A. Wightman, superintendent of these works, and he is applying milling more extensively than anything I have hitherto seen on heavy material. The leading obstacle to applying milling machines economically to heavy work has been the difficulty of making and keeping in order the large cutters required, for the heavy steel tool is apt to crack or become distorted in hardening. This source of expense and annoyance is prevented here by the use of milling tools having inserted teeth, and there is no operation found too heavy for the application of the milling cutter. A great deal of the cylinder finishing, rod work, fitting of axle boxes, shoes, link work, strap rod ends, etc., is done on the milling machines, and is reported to be more cheaply and accurately performed than anything done by a first-class hand on a planer. In the case of rod brasses, for instance, the bottom, sides and ends of flanges are surfaced at one cut ready for the strap at half the cost of labor that the same work incurs on a planer.

The gauge and template system is very highly developed here. When an order is received for a group of locomotives that are not the standard of the works, the first procedure is to make templates with hardened bushings to fit the parts. This is an expensive operation, but it pays in labor saving and in the improved character of the work produced. Under this system all work is produced of an exact size, not that it may fit some particular place. When a lathesman is turning a crank-pin he does not know anything about what wheel it is going into. He fits it to an accurately bored bush, and the man who bores the hub uses a plug gauge a certain size larger than the bush, so every pin and every pin hole in all engines of the same class agree in making a driving fit. All smaller fittings are got out on the same plan, the parts are finished on a manufacturing basis. Our English friends who prate about the inaccurate fitting of American locomotive work ought to work in a shop of this kind for a year to teach them something about fitting on a sensible basis. The hardened bushings used are movable and are attached to a handle. When a machinist is drilling the holes in a cylinder head, for instance the template is clamped to the head and the hardened bush is moved from one socket to the other as the drill gets through. When the bush begins to wear on the inside where the drill keeps rubbing it so that it is not true enough for the original hole it is ground out to the next size, so that before a bush is worn out it does service in a variety of sizes. These works have abandoned the practice of coring holes in cylinder heads and other castings.

The ground where the shops are located is in the form of a rectangle, and the buildings are arranged in a way that reduces the handling of material to the smallest limit. The machine shop and offices occupy the whole front on the main street. There is a transfer track outside the machine shop, and at right angles to this, the blacksmith shop and other buildings stand, an arrangement which enables all heavy material to be transferred on flat cars. Cranes are provided all over the works for lifting heavy articles, so that nearly every operation in handling material is facilitated by power. The heavy tools in the machine shop are nearly all located close to the side traversed by the transfer table, and convenient to the blacksmith shop and foundry, so that heavy articles, such as cylinders, driving wheels, frames and the like, have not to be conveyed through the body of the shop. As far as possible the machines are arranged in rows, with clear space between them, and tools devoted to the same kind of work are grouped together. One room contains all the machines working on bolts and screws, while another is devoted exclusively to brass working tools. Compared with other shops the conspicuous feature about these works is the number and variety of milling machines in use, but the supply of the most approved metal tools of other kinds is good. Among those noted were several double-headed shaping machines, four-headed planers, multi-headed drill presses, heavy wheel lathes, boring mills, quartering machines and numerous turret lathes.

The natural gas, which is the crowning glory of Pittsburgh and the pride of every citizen, is extensively used in these works for heating and metallurgical operations. A ten-inch pipe for conveying the gas is carried through the shops on the outside under the roof eaves. Great attention is paid to promoting the comfort of the workmen, very convenient washing and bath rooms being provided with hot and cold water.

Payment on the basis of results is followed in nearly all the mechanical operations. The men appear to be well satisfied with the piece-work system. My experience has been that good mechanics who are willing to do a fair day's work thrive and make money by the contract system, but it kills the loafers and inferior hands root and branch.

This company has recently erected the finest foundry in America, so far as I have seen, but I must defer notes of that establishment. A. S.

Engineering and Shop Notes.

MORAL ATMOSPHERE OF DIFFERENT SHOPS.

There is a striking difference in the moral atmosphere of the various railroad mechanical headquarters throughout the country. When a man of inquiring mind, as all newspaper men ought to be, visits some shops, he finds every representative of knowledge and authority fallen into a anchylose condition that resists the most skillful and persistent efforts to extract information. As a rule, this condition comes out most conspicuously where there is nothing to be seen or heard worth knowing. In other shops and offices again, one finds ideas of progress on every hand, and every man around ready to aid in the diffusion of useful knowledge. In the shops run with indigence of ideas, it is natural that they should not wish to part with any of their too limited stock, but men with brains and ability, and progressive impulses, recognize that they profit by the mutual practice of giving snd receiving; and they give freely that cthers may be helped by the work they have done and the discoveries they have made. These reflections were forced on me by the memory of contrasts during a pleasant reception I recently experienced at the

PAN HANDLE SHOPS AT COLUMBUS.

The new shops belonging to the Pittsburgh, Cincinnati & St. Louis Railroad, which are designed to do the mechanical work for a considerable portion of the great Pennsylvania Railroad system, are located about a mile and a half east of the Union depot at Columbus, and are on a fine, level, well drained plot of ground some 73 acres in extent, owned by the company. Plans for the shops were first worked out by Mr. E. B. Wall, some four years ago, when he was assistant engineer of the mechanical department. The drawings were discussed, considered, and criticised for about a year, and after a few changes were finally adopted and the shops built. They have been occupied only a few months and are not yet entirely finished. About the time the building was commenced, Mr. Wall was appointed superintendent of motive power, which prevented him from attending to the details of construction, and this work was performed by Mr. S. S. Harrington, assistant engineer. The designing and details of the shops are highly creditable to all concerned.

Before mentioning particulars about individual shops, a few features that are common to all might be spoken of.

LIGHTING AND HEATING.

All the shops are lighted by the arc electric light, the electricity being generated by a 60 H. P. engine driving one of two dynamos, a large arc for full lighting service, or a small one for overtime work, when a limited number of lights are wanted.

All the shops are heated by the admirable Sturtevant hot blast steam heating apparatus, similar to that described in the NATIONAL CAR AND LOCOMOTIVE BUILDER of January, 1886, as being in use in the Chicago & Alton shops at Bloomington. The system heats the shops by exhaust or live steam. This passes into coils of pipes or radiators grouped in a box through which the air is passed by means of a fan operated by an independent engine, or in connection with the shop shafting. From the heating box, the air is conveyed through the shops by ducts made of galvanized iron, the quantity of heat escaping at any given point being regulated by dampers. The practice is to start up the heating apparatus in good season in the morning, so that each shop has a comfortable temperature before working hours. The system works well, is economical of heat and prevents the men from diverting their energies from their work in order to warm themselves, as has to be done in parts of so many shops during severe weather.

GOOD SUBSTANTIAL FLOORS.

A striking feature about all the shops is the ground flooring, all uniform in appearance and clean. As a good substantial floor is a still felt want in numerous shops, many of our readers are likely to be interested in how these floors are made. They consist of three layers of material. Below is a course of broken stone six inches deep, next comes eight inches of finely broken stone mixed with cement. The top layer is four inches deep, and consists of a mixture of Portland cement, asphalt and sand. The floor surface looks like clean flagstone, but it is said to have a slight elasticity which prevents breakage from sudden blows or over pressure, trying conditions that are certain to be put upon any floor where heavy work is in progress as in a machine shop.

THE MACHINE SHOP,

Which is the heart of the establishment, is an oblong brick one-story building, finely lighted by side windows and skylights. The boiler shop occupies one end of the machine shop building at present, but when increase of works demands more room, the boiler makers will be relegated to a new shop which forms part of the plan of the works. The machine shop contains a well-selected stock of good tools, so arranged that when an increase is made, setting the new tools will not entail the moving of the old ones. Among the tools already in use are wheel lathe, and hydraulic press, various sizes of smaller lathes, planers, slotters, milling machines, emery grinder, boring mill, cylinder-boring machine, quartering machine, etc. The machinery is driven by a fine Brown automatic engine. The building is traversed by an eight-ton Yale & Towne traveling crane fitted with overhead trolly for moving loads transversely. This crane is arranged with gearing to lift light and heavy loads at different speeds. There are six erecting stalls in the shop at present, but the capacity in this respect can be easily increased as the requirements arise. Five engines are in the shop, most of them receiving heavy repairs. A machinist running an engine lathe in this shop uses a neat trick to save himself from lifting heavy weights. He has a small block and fall hung above his lathe, and when he has a driving box or similar article to raise from the floor, he hooks the block upon it, and taking a turn of the line round any convenient part of the lathe, starts it up, using the lathe as a hoist.

Power is transmitted from the machine shop to the blacksmith shop, a distance of 275 feet, by a small hemp rope run about 1,500 feet a minute. The rope is kept taut by means of a suspended weight acting like the weights that keep street car cables from sagging.

THE BLACKSMITH SHOP.

The blacksmith has been a mighty man in the world's history. He has been the originator of all artizans who work in metals, but of late years he has become conservative, or kept up his notions of advancing slowly, so that other trades, notably machinists, have left him behind. In some shops the blacksmith's tools retain something near medieval simplicity, but in progressive shops the blacksmith is becoming something of a machinist. The Panhandle shops have a progressive foreman who worships not the past alone, and he uses all sorts of ingenious contrivances and special machines that help to produce forgings quickly. All varieties of formers are in use, and are very successfully employed in connection with the steam hammers. By a device of this kind made specially for forming and forging coupling links, 1,300 links can be formed in a day by two men and a boy, and 800 can be welded in a day by the same force. There are two steam hammers in the shop, one of two thousand pounds and the other of one thousand pounds capacity, a machine for making bolts, a flue welder, drill press, grindstone, and a truss-rod upsetting machine. As these labor-saving appliances are kept constantly at work, they vastly increase the capacity of the shop. Within two months I visited a shop which has twice the fires used in this one, and three times the men, and it turns out less work. Mr. George Miser, the foreman of this shop, invented a very convenient and cleanly twin forge, which is used in the shop. Two of the forges are set on one frame, each fire being petitioned off from the other by a sheet-iron screen, an extension upwards forming the smoke-pipe. The smiths using the twin forge stand to the left of each other, but facing in opposite directions. From every four sets of the forges the smoke is carried to a main stack, the arrangement keeping the shop quite free from smoke. There is an easily-operated dumping arrangement under the hearth of each forge. Master mechanics who contemplate a reformation in their blacksmithing establishments would do well to pay a visit to Columbus.

CAR REPAIR SHOP.

This building is situated at one end of the grounds, and is built in the section of a round-house with 15 stalls. The work going on at present is mostly light repairs, but they are very busy with that. In the passenger department they are remodeling a parlor car and finishing it in quarter oak. There were seven passenger cars and fifteen freight cars in the shop. The shop is reached by a turn-table one hundred feet long—the longest turn-table in the country. Sufficient room is left between the turn-table and the inner walls of the car shop to hold one passenger car or two freight cars for light repairs. The turn-table is of the ordinary iron beam type, but there is a minor point worthy of special mention, and that is the means of holding the bolt that keeps the table set for the required track. Long U-shaped castings are set in the wall, and the bolt connected with the table is held in one which is in the middle of the track to be used. The casting is long enough to permit the bolt to move vertically without striking.

THE PLANING MILL.

This is an oblong building, 90 × 160 feet, situated near the car repair shop. Like all the other permanent buildings, this one is built of brick, and is well lighted by windows in sides and roof. It contains a fine plant of the most approved wood-working machinery, so arranged that the lumber is moved from the yard to the machine that performs the first rough operation, and from thence is kept going onward till the finishing touch is given making it ready for the erecting department. There is in use in this shop a special machine for forming car bolsters, which is worthy of particular mention. Cutters revolving on horizontal spidles gain off the ends of the timber which is passed under them on a movable table, then small vertically set cutters champer the edges by an extension of the first operation. The machine does the work with amazing rapidity and accuracy. It finishes a bolster from the rough timber in about four minutes.

THE ROUNDHOUSE.

There are 37 stalls in the engine roundhouse. The smoke-jacks are provided with movable hoods which are lowered to the stacks of the locomotives, greatly helping the draft during the process of steam raising. One stall is provided with a drop pit and table, operated by hydraulic power for the removal of driving wheels or engine trucks without the labor of jacking up. In all respects the roundhouse is worthy of the perfected condition of the other shops.

COALING STATION.

Perhaps the greatest novelty about the place is the coaling station, which is situated near the entrance to the roundhouse. It consists of an overhead traveling crane of ten tons capacity, carried on two trestles 24 feet high and 400 feet long, and spaning 50 feet of space, which is occupied by tracks for holding coal cars and for admitting the engines to be coaled. The crane consists of a bridge of two wrought iron girders, connected at each end by a two-wheel truck, with double flanged wheels and chilled treads. Power is communicated to a drum, which is geared to the main shaft of the engine. To this engine is attached a boiler, which is sheltered by a cab, where the operator stands. Convenient to his hand are three levers, by which he is enabled to cause the bridge or car to travel longitudinally in either direction, or to move the hoisting mechanism in the required direction. The bridge and lifting apparatus may be moved separately or simultaneously as desired.

The coal is handled in iron buckets, which are laid alongside the coal cars, and stand on wheels attached to the bottom. They are made of ¼-inch boiler iron and have a capacity of about 2 tons. The buckets are wonderful pieces of mechanism. They have four bales or handles which join in the center, so that the block hook of the traveling crane can grip the bucket in either direction. In the center, at the bottom of each bucket, are two doors or traps held in position by clutch hooks, so when the bucket is full and in position over the tender, the operator has but to touch the lever and two tons of coal are dumped into the tender. When the buckets are lowered for refilling, the trap-doors close automatically, and are locked by the clutch until tripped again. An indicator of special design is used, which shows how many pounds are in each bucket.

There are many other things about the shops well worthy of mention but limited space forbids me describing them at present.

PERSONAL.

When the works reach their full capacity, it is expected that about 1,500 men will be employed, but at present the force is not beyond 700. Mr. Robert Curtis is master mechanic in charge, and his duties are lightened by a very able corps of foreman and assistants. Mr. Charles Michael, general foreman of the locomotive department, and Mr. J. L. Copeland, general foreman of the car department, are both able men, as the work done in their respective lines testifies.

A. S.

The Alabama Car Works.

These works have recently been organized at Anniston Ala., and are the successors of the works of the Anniston Car Co., which suspended operations early in 1885, owing to the dullness which then prevailed in car construction. Some parties in Anniston, impelled by the renewed activity in railroad matters and the increasing demand for cars, formed a stock company under the name of "The Alabama Car Works," and in October last obtained a lease of the property of the former company and immediately began putting the shops in a condition for heavy work. Thorough repairs have been made and new and improved machinery introduced, and the works are now busy in filling large orders, which they are enabled to do with great promptness by running on double time with the aid of electric lights.

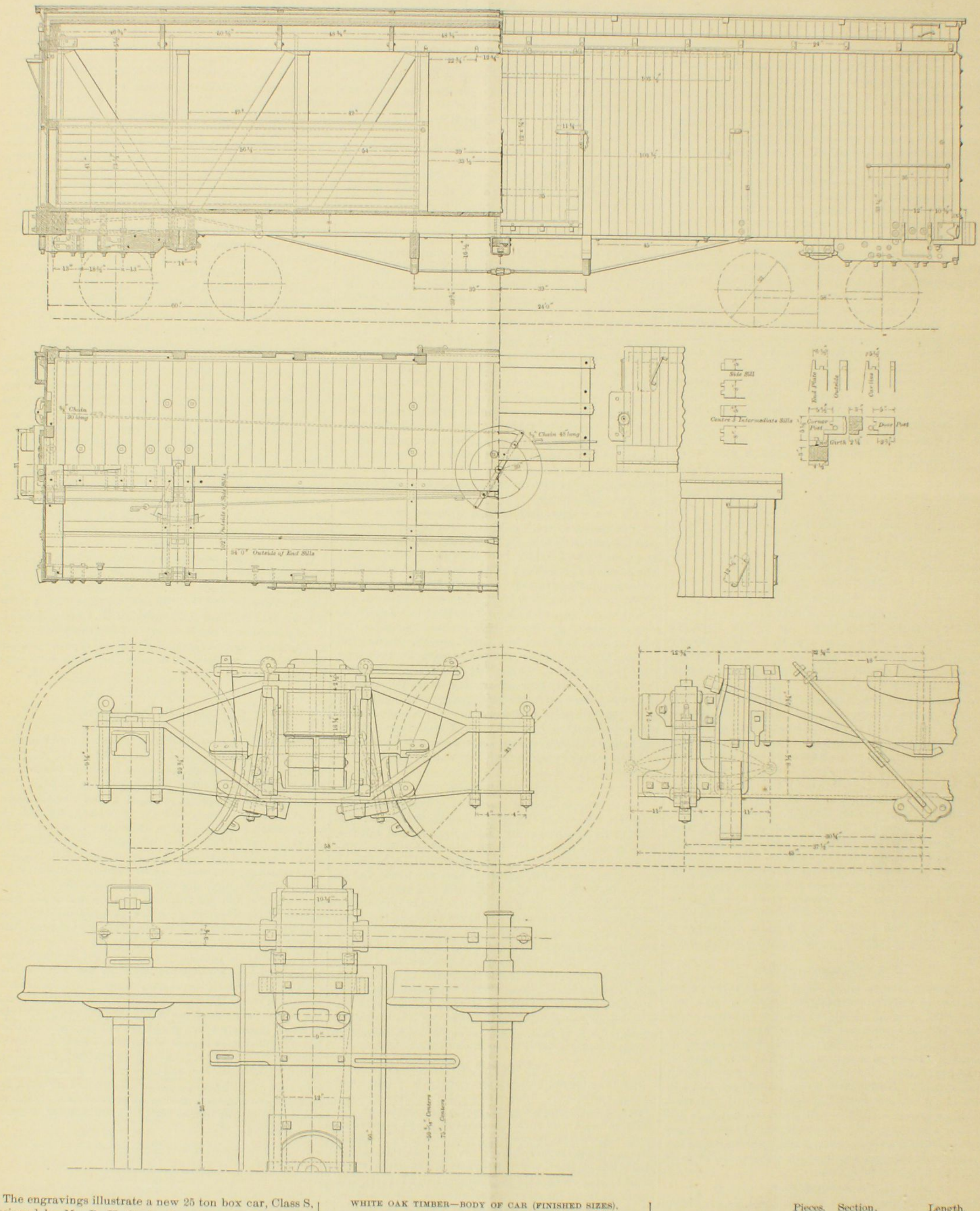
The locality is peculiarly favorable for procuring the best material for construction, being in the heart of the Southern long-leaf pine region, where no turpentine is made and where this kind of lumber is all first-class. At the very doors of these car works are the car wheel works of Noble Brothers & Co., which use nothing but the Clifton and Woodstock brands of car wheel iron. The axles made by this firm are of hammered, re.rolled muck bar, largely of charcoal iron, and are a marvel of strength and durability. With these superior advantages afforded by an extensive and easily accessible iron and lumber region, the new enterprise has an excellent outlook for a prosperous future.

Porter Locomotives.

Writing about the business done during the past year, the Porter Co., of Pittsburgh, mention that their output of engines has been to widely scattered regions. They sent locomotives to Arizona, Wisconsin, Mississippi, Massachusetts, Georgia, Arkansas, Kentucky, Oregon, Colorado, Tennessee, California, Washington Territory, New York, Florida, Virginia, Ohio, Illinois, Michigan and Pennsylvania. They also exported engines to Mexico, Canada, Yucatan, San Domingo, United States of Colombia and Venezuela. Their build of engines has now got beyond 800. They have locomotives running in all the States and Territories in America, besides having them in most foreign countries with any considerable railroad mileage. They have five engines running in Japan, and claim to be the only builders in this country that have sent locomotives to Asia.

BOX CAR (50,000 LBS. CAPACITY)—NEW YORK, LAKE ERIE & WESTERN RAILROAD.

Designed by R. H. Soule, Supt. Motive Power and Machinery.



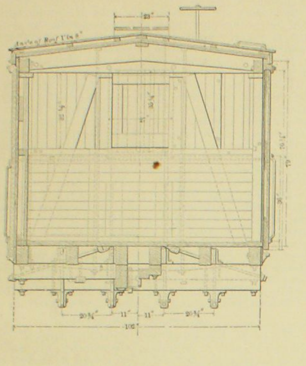
The engravings illustrate a new 25 ton box car, Class S, designed by Mr. R. H. Soule, Superintendent of Motive Power and Machinery of the New York, Lake Erie & Western Railroad. The following detailed specifications, in connection with the drawings, give a clear idea of the construction. In its design, material and workmanship, the car is a good representative specimen of its class, and is deserving of the attention of railroad men.

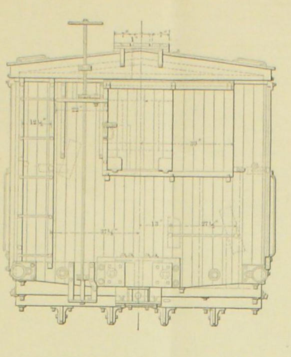
GENERAL DIMENSIONS.

Length over end sills	34 ft.	0 in.
Width " side "	8 "	6 "
Height in center, from top of sills to under side of under course of roof boards	7 "	2⅝ "
Height at sides, from top of sills to under side of under course of roof boards	6 "	8 "
Outside of end sill to center of body bolster	5 "	0 "
Width of opening—side doors	5 "	7 "
" " end "	2 "	0 "

WHITE OAK TIMBER—BODY OF CAR (FINISHED SIZES).

	Pieces.	Section.	Length.
Sills, end	2	8 × 10 in.	8 ft. 6 in.
Bolsters, body	2	6½ × 14 "	8 " 6 "
Tie timbers, cross frame	2	4 × 11 "	8 " 6 "
Posts, door	4	4 × 5 "	6 " 0½ "
" corner	4	5½ × 5½ "	6 " 0½ "
" body	8	3 × 5 "	6 " 0½ "
" "	4	3½ × 5 "	6 " 0½ "
Braces, body, side	4	2⅛ × 5 "	7 " 4½ "
" " "	8	2⅛ × 5 "	7 " 3¼ "
" " end	4	2⅛ × 5 "	6 " 5½ "
Girths, side	4	3 × 4 "	13 " 7¼ "
" end	2	3 × 4½ "	7 " 10 "
Plates, end	2	3½ × 12⅞ "	8 " 6 "
Carlines	7	2 × 11⅞ "	8 " 6 "
Buffer beams	2	5⅝ × 12½ "	2 " 11 "
Filling blocks	2	9 × 9⅞ "	1 " 6⅞ "
Draw timbers	4	5 × 9⅞ "	4 " 8⅞ "
Dead blocks	4	4¼ × 8½ "	0 " 10½ "
Running board blocks	7	2½ × 2 7/16 "	1 " 11 "
" " "	2	5⅝ × 2 7/16 "	1 " 11 "
Ladder sides	2	2 × 3½ in.	6 ft. 5½ in.
" "	2	2 × 3½ "	6 " 8 "
Brake lever blocks	1	4 × 7½ "	1 " 7 "
End step	2	1½ × 6 "	1 " 7 "
Door guide rail, top, sides	2	1½ × 2½ × ⅝ "	10 " 7¾ "
Door guides, top, ends	2	3⅛ × 4 "	4 " 6½ "
Door wearing strips, end	2	0¾ × 1½ "	4 " 6½ "
Door stops, sides, top	2	2 × 4 "	5 " 7 "
Door stops, end	2	2 × 2 "	2 " 11⅛ "
Caps for sheathing, sides,—may be madé in 3 pieces	2	1¾ × 4 "	34 " 3½ "
Caps for sheathing, ends	2	1¾ × 4 "	8 " 6 "
End step bracket	2	2⅛ × 3 "	2 " 2½ "
Angle strips, floor	4	2½ × 3 "	12 " 6 "
" " "	2	2½ × 3½ "	6 " 9 "
Filling pieces, over end doors	2	0⅛ × 4⅝ "	2 " 0 "
Butt strips under draft sills	2	1¾ × 5 "	6 " 2 "
" " " " "	4	1¾ × 5 "	8 " 0 "
Door rail filling piece, end	2	2⅛ × 3 "	1 " 6 "
Nailing piece for lower ends of sheathing under end doors	2	3½ × 4 "	2 " 0 "





Oak to be of best quality, free from rot, shakes, bad defective knots, and to be at least one half seasoned.

GEORGIA YELLOW PINE—BODY OF CAR (FINISHED SIZES).

Sills, side	2	5 × 8 in.	32 ft. 11 in.
" draft	2	5 × 8 "	32 " 11 "
" intermediate	2	5 × 8 "	32 " 11 "
Plates, side	2	4 × 5¼ "	34 " 0 "

Yellow pine to be of first quality, free from shakes, bad defective knots and sap.

NORWAY PINE—BODY OF CAR (FINISHED SIZES).

Ridge pole	1	1¾ × 5 in.	34 ft. 0 in.
Purlines (may be in two pieces)	6	1½ × 2 "	34 " 3½ "
" " " " "	2	1½ × 4½ "	34 " 3½ "
Running boards (may be in two pieces, providing no two joints come on same leveling piece)	3	1¼ × 7 "	35 " 1¼ "
End plate filling piece	4	1¾ × 2½ "	4 " 4 "
Roof battens	18	0¾ × 2 "	4 " 5¼ "

Lower roof boards and inside lining all ⅞ in. thick, about 4 in. wide, planed, tongued and grooved.

Flooring 1¾-in. thick, and not more than 6 in. wide, planed, tongued and grooved; pieces to be full length (8 ft. 6 in.), except in door openings, where the length should be 8 ft. 7¾ in.

Norway pine to be seasoned and of good quality, free from sap at least on one side, free from shakes and without black or large red knots.

WHITE PINE TIMBER—BODY OF CAR (FINISHED SIZES).

Eaves, bands, side	2	0⅞ × 5⅝ in.	34 ft. 5¼ in.
" " ends	2	0⅞ × 12 1/16 "	8 " 11 "
Door post liners	4	1½ × 3¾ "	5 " 9¾ "

Upper roof boards and sheathing, all ⅞ in. thick, about 4 ft. wide, planed, tongued and grooved.

Side and end doors made from ⅞ in. thick white pine, about 4 in. wide, planed, tongued, grooved and supported by battens.

Upper course of roof boards, sheathing and side and end doors, to be of a quality of lumber which shall stand inspection under the following specification for 3d clear white pine lumber N. Y., L. E. & W. R. R. Boards should be thoroughly seasoned, 8 in. wide and over, and, whatever width, must have one face side free from sap. All boards in this grade must be entirely free from shakes. Boards with the following defects will be acceptable: Three to five (according to width of board) perfectly sound red knots, not exceeding one inch in diameter on face side; or from three to five inches of sap on the reverse side, according to width of board.

TIMBER FOR ONE PAIR OF TRUCKS, WHITE OAK (FINISHED SIZES).

Bolsters	2	9¾ × 12 in.	7 ft. 6 in.
Spring planks	2	2⅝ × 11¼ "	7 " 6 "
Brake beams, hickory, finished sizes	4	3½ × 7 "	5 " 6 "

MODE OF CONSTRUCTION.

Floor Framing.—Longitudinal sills framed into end sills by double tenons. Each corner of floor frame secured by one ⅞ in. strap bolt.

Body Bolsters and Tie Timbers.—To be gained for sills and secured in proper place, as shown.

Truss Rods for Body Bolsters.—Each bolster to be trussed by four 1 in. wrought-iron rods; nut ends to be upset to 1¼ in. diameter; heads to be 2 in. square, 1 in. thick.

Girths and Girth Tie Rods.—Girths to be gained for posts and braces, as shown, to be secured to posts and braces by steel screws, four 2 in. No. 14 screws at each intermediate post, three screws same size at each corner and door post, four 3 in. No. 15 screws at each side, and four 3½ in. No. 18 screws at each end brace. Lower inside edge of girth to be rabbeted. Tie rods ⅝ in. diam., six in all, one across each end of car under girth, and two along each side of car over girths.

Side rods extend from door posts to and through corner posts and end sheathing, with strap end secured to door posts.

Floor Fastenings.—Floor to be nailed by 20 d. cut nails, two in each sill in each floor piece over 4 in. wide. Where posts seat castings, lip over inside of sills, nailing-blocks for floor to be nailed to inside of sills, and flooring to be rabbeted for plates of castings. Flooring to be laid crosswise of car. Pieces to be of full length outside to outside of side sills, except in doorways, where they should extend to outside of sheathing.

Center-plate and Side Bearings.—To be of cast-iron, secured in place, as shown.

Corner Door and Body Posts.—These posts to be set in cast-iron pockets and caps, with flanges to receive head and foot of braces. Door post, bolster post and end post to have cast-iron pockets with lipped flange hooking over inside of sills. Castings to have dowels for framing, door posts to be lined inside with pieces of white pine extending from floor to cap casting for nailing grain boards to.

Sill and Plate Rods.—Rods to be ⅞ in. diameter, 20 in number; to have wrought iron washer 2⅞ in. square, ½ thick under heads and two nuts and cast-iron washers on each. Four of these rods pass through body bolster and four through cross frame tie-timbers.

Protection of End Sills.—Outside face and upper edge of end sills to be painted with the Winslow asphalt roofing paint, and while paint is wet the outside face is to be covered with one thickness of the roofing felt with edge turned 2 inches over top of sill; paper to be well tacked in place and to receive one coat of the roofing paint. Pieces of extra heavy zinc, 8 in. × 35 in. (one each end) to be bent to fit angle formed by the upper beveled face of buffer beam and outside face of nailing piece for lower ends of sheathing under end doors; outside edge of the zinc to be one-half inch from outside face of buffer beam; zinc to well tacked in place.

Sheathing and Sheathing Cap.—Sheathing to be nailed with 2¼ in. No. 9 barbed nails, four in each piece at sill, two in girth, two in plate; also nailed to all braces with one nail in each board, pieces to be of full length from under side of sills to upper edge of rabbet in sheathing cap, except the sheathing under side doorways, which is to extend from bottom of side sills to under side of flooring; sheathing under end doorways from nailing strip over end sill (between end posts) to upper side of end girth and sheathing under (top) door rails to extend full length of door opening. Sheathing caps to be well secured to plates with 4 in. No. 6 barbed nails, staggered. Filling pieces to be well secured to end plates by 4 in. No. 6 barbed nails.

Inside Lining.—To be nailed with 2½ in. No. 9 barbed nails, two in each board at each post. A space of two inches to be left between floor and lower edge of lining. Beveled strips fastened on top of floor and against inside of sheathing between posts and braces, as shown by drawings, to be well nailed with 2½ in. No. 9 barbed nails. Door sills in sides of wrought iron ¼ in. × 3½ in., well fitted between door posts bent to fit angle of floor, let in floor flush, and well secured to floor with 2½ in. No. 18 steel screws, 13 screws in each plate. Door sills for end doors of wrought iron ⅝ × 2½ in. well fitted between posts and secured to end girth with 1½ in. No. 16 steel screws, five screws in each sill, door sills countersunk for screw heads.

Plates and Carlines.—Plates to be gained and mortised to receive carlines; carlines to be secured to side plates by one ½ in. strap bolt, each end of each carline. End plates and carlines secured at each end to side plates by two 2½ in. No. 16 steel screws. Plates to be framed together at corners and well secured by wrought-iron corner plates.

Ridge Pole.—To be let into carlines and end plates, and well secured to same by 3 in. No. 15 steel screws, two in each carline and three in each end plate.

Roof.—To be the Winslow Asphalt Roof. Under course of roof boards to run longthwise of car, with joints well broken. Boards to be well secured to carline and plates with 2 in. No. 9 barbed nails, two nails in each board at each fastening. Upper surface of boards to be made smooth; all nails to be set in so as not to injure or tear the felt.

Felt, Manner of Applying.—Start at one end of the car, allowing the felt to project one inch over the end and three inches over the side of roof. Unroll the felt, letting it lie loose, being careful not to draw it tight, so that it will not tear if the roof is strained. Turn down the felt over sides and ends, tacking it once in six or eight inches with 10 or 12 oz. tacks. Apply the next strip of felt, allowing it to lap over the first strip, not less than four inches; paint the lap with hot asphalt paint and stick the laps together. In lapping over ridge, paint lap in same manner. In painting laps do not get any of the paint under the felt, as it would stick the felt to the roof boards. Smooih boards should be laid on the felt to walk on, to prevent the felt from being torn or broken. After the felt is applied, give it a good coat of hot asphalt paint.

Battens.—As soon as felt is painted, and while the paint is wet, place one batten over each end plate and carline and tack them at each end to hold them in place until purlins are applied.

Purlins.—To be well secured in place with steel screws 5½ in. long passing through battens, roof boards and ridge pole into carlines, end plates and side plates.

Distance Blocks of hardwood to be placed between side bands and sheathing cap; blocks to be tacked in place and to have ⅝ in. lag screws pass through them.

Bands.—End band to be secured to end sheathing cap and filling pieces, and to ends of purlins with 2½ in. No. 9 barbed nails. Side bands to be secured to purlins and ends of end bands with 2½ in. No. 9 barbed nails, and to sheathing cap and side plate with ⅝ in. lag screws, 18 in each side, (16 5 in. loug and 2 3 in. long). Distance blocks of white oak ¾ in. × 2 in. × 3 in. placed between side bands and side sheathing caps, one lag screw passing through each block. Sheathing cap to be cut out for end door top guide.

Upper Roof Boards.—To be of full length from centre of ridge to outside of roof; to be well secured to purlins with 2 in. No. 9 barbed nails, two nails in each board at each fastening. Boards also to be nailed to upper edge of bands with same sized nails as above, about one foot centers.

Running Board Leveling Blocks.—Leveling blocks are placed over each end plate and carline, each to be secured in place with two 3 in. No. 20 steel screws in center purlins and one 3½ in. No. 20 steel screw (counterboard ½ in. in block) in each end of leveling blocks into intermediate purlin under ends of blocks.

Running Boards.—To be well secured to leveling blocks with 2¼ in. No. 18 steel screws, three screws in each board at each fastening. If boards are made in two pieces, as noted in bill of material, six screws must be used at joint instead of three; ends of running boards to be supported by wrought iron brackets.

Roof Handles.—Wrought iron handles, one on brake shaft end of roof and two on opposite end, to be well secured to car roof through proper filling blocks, shaped so as to shed water.

Buffer Beams and Dead Blocks.—The buffer beams to have upper face beveled, and to be secured to car (against the roofing felt on end sill) with two ¾-in. bolts through each beam and end sill, and two ¾-in. draw-gear tie rods through buffer beams, end sills and body bolsters. Dead blocks to be faced with castings bolted to buffer beams, with heads and nuts countersunk.

Draw Timbers.—To be well secured to car with five ⅞-in. bolts through each timber, four of these bolts to have cup floor washers, and three pass through cast-iron lock plates. Timbers to be mounted with cast-iron draw-bar stops, well secured in place. A block of wood 1¾ in. thick to be nailed to outside of draw-timbers with 12 d. cut nails, locking all the nuts on side bolts through draw-bar stops.

Doors and Fittings.—Wagner doors to be used on sides of cars. Outside of side and end doors to be made of ⅞-in. white pine sheathing; boards to extend from bottom to top of doors; all pieces to be of full length; this sheathing to be well secured to ⅞-in. white pine battens on inside of doors, with 2-in. clinch nails. Side doors to slide on wrought-iron bottom door track, and guided by upper wrought-iron door track; bottom door track to be set out on castings, and upper door track on filling piece of wood secured in place by ½-in. bolts. Door shoes of cast-iron, secured to door by three ½-in. bolts in each. Heads to be let in battens flush. Guide castings on ends of eccentric rods of cast-iron. Eccentric rods of wrought-iron held to doors by cast-iron caps, with wrought-iron wearing plate under same on doors. Hasp on eccentric rods of wrought-iron, to be keyed in place on rods.

Lift and lift block to be of malleable iron; block to be secured to door by two ½-in. bolts with heads let in inside, filling piece flush. Eye-bolt and lock-plate for hasp on eccentric rod, to be of malleable iron; lock plate secured to inside of door by ⅜-in. No. 12 steel screws. Door handles of cast-iron, secured to door by 1¾ in. No. 16 steel screws. Doors to be protected or faced at ends by 2 in. × ⅛ in. wrought iron, let in flush and secured by ¾ in. No. 12 steel screws.

Door stop of cast-iron, secured to car by one ⅝-in. bolt, with head let in flush in side girth. Eccentric rod to be provided with staple stop over lift. Door posts and top stop to be rabbeted to receive door; bottom of door to be beveled to fit wrought-iron door sill. End doors to slide on wrought-iron bottom door track, set out on castings and secured in place by ½-in. bolts. Door shoes of cast iron, secured to lower corners of doors by ½-in. No. 16 steel screws. Door stops to be secured in position by ½-in. bolts. Top of door to slide in door guide, gained on inside for door and beveled on upper side to shed water, to be secured in place by ½-in. bolts. A wearing strip of oak for upper inside edge of doors, secured in place by 6 d. nails; doors to be provided with inside fastening on stop side of door; side and end doors to be furnished with hasp, staple bolts, hook and chain.

Draw-bar and Follower Plates.—The Thurmond patent draw bar (malleable iron), or some similar patented draw-bar to be used. The N. Y., L. E. & W. R. R. Co. to assume the royalty charges whatever form of patent coupler is selected. Draw gear to have a separate draw bolt 2 in. diameter, with iron key ⅜ in. × 2½ in. section. Followers of wrought-iron 1¼ in. thick, 6¾ in. × 8¾ in., with 2⅛-in. hole.

Body Truss Rods.—Truss rods to be four in number, made of 1-in. round iron, with nut ends upset to 1¼ in. diameter; rods connected in center with pressed wrought-iron open turn-buckles. Rods to pass under bearings on cross frame tie timbers and over body bolsters on cast-iron saddles provided for the purpose, then through end sills and large cast-iron washer under nuts.

Brake Shaft.—To be of 1¼ in. diameter wrought iron, with an enlargement at lower end 1½ in. diameter, forming drum for chain to wind upon; to be furnished with cast-iron bearings, wrought iron step, ratchet, pawl, wheel and all necessary connections; ratchet, pawl and plate to be secured to roof of car.

Ladders, Steps and Handles.—Each car to be provided with a ladder at each end, having rounds of ⅝ in. round iron, secured in place as shown; also end steps supported by wrought-iron brackets secured to each end of car near upper end of ladders, two sill steps secured to sills, two side handles secured to corner posts and braces, two end handles secured to end and corner posts.

King Bolt of wrought iron, 1⅝ in. diameter, with solid head resting on top of body bolster. Provision to be made in floor of car for removing pin, as shown.

Card Racks.—Each car to be provided with two card racks, one on each side of car, secured to sheathing near side door with 1 in. No. 12 steel screws.

Trucks to be 4 ft. 10 in. center to center of axles. Frame bars of best quality wrought iron, upper 1½ in. by 3½ in., lower 1 in. by 3½ in., and tie bar ½ in. by 3½ in. section.

Pedestal bolts 1⅛ in. diameter, box bolts 1 in. diameter, two cuts on each. Bolster to be mounted and secured, as shown, and trussed by two 1⅛ in. square wrought-iron truss rods, having nut ends upset to 1⅜ in. diameter, springs to rest on pieces of white oak plank in 12 in. channel bar that is 7 ft. 6 in. long, and about 29½ pounds per lineal foot.

Journal Boxes and Bearings.—Journal boxes to be of the M. C. B. pattern, spring lids, fitted with M. C. B. bearings and keys. Bearings to be "Hopkins patent lead-lined," and cast from mixture of copper 85 parts, tin 14, zinc 1. Bearings should weigh 10 lbs. each on average when ready to go on the journals. Lead lining should not weigh more than ⅝ lb., leaving the average weight of brass without lead lining 9⅜ lbs.

Safety Chains.—A ⅝ safety chain 22 in. long to be attached at each corner of truck by an eye-bolt and to car by wrought-iron hook.

Axles and Wheels—Axles to be made of best hammered iron. New muck bar must be used, which must be thoroughly reworked at least once before being heated for the finishing hammer; it must be tough, fibrous, uniform, and free from scrap. If reworked by rolling, none of the slabs must be more than ¾ in. thick when piled for the axle. If reworked by hammering, the power of the hammer must be sufficient to work the pile to its center to the satisfaction of the railroad inspectors. Such axles must stand without fracture three blows at 10 ft., and two blows at 15 ft., of a 1,640 lb. weight, striking the axle midway between supports three feet apart, axles being turned after each blow.

Wheels to be 5¼ in. over tread and flange, and guaranteed for four years' service; to weigh 550 lbs. Wheels to be marked with one inch raised letters and figures, as follows: Name of manufacturer on the outside of the wheel; the number, month and year made on the inside of wheel; the number to be consecutive; commencing with number one (1) where wheels are the first that are finished by maker. A record to be furnished by them. Wheels to be well fitted to and pressed on axle at a pressure not less than 60,000 lbs. Gauge for mounting wheels will be furnished. All failure of wheels to perform the service guaranteed shall be settled for on presentation of proper bills by the company against the contractors for the cars on the basis of 15 cents per month per wheel for the shortage of service below the guaranteed limit of four years.

Springs to be, for draw-bar, a double coil steel spring, N. Y., L. E. & W. R. R. Co. standard. Truck bolster springs to be the Pennsylvania R. R. bolster spring, Class V., described as follows: Four bars, 1⅛ in. dia., 51⅜ in. long, tapered to 58⅜ in.; weight of steel, 51⅜ lbs.; caps of malleable iron; heights, 6⅛ in. free, 4⅝ solid, 5⅛ in., with 16,700 lbs.; capacity, 42,000 lbs.

Coupling Link and Pin.—Each car to be furnished with one coupling link and two pins, N. Y., L. E. & W. standard pattern.

Castings and Forgings.—All castings and forgings to be in accordance with drawings; all castings to have raised letters and figures giving N. Y., L. E. & W. R. R. pattern class fication, no builders' pattern marks to show on castings.

Brakes.—To be attached to both trucks on each car between the wheels. Brake heads and shoes of cast iron. Brake levers of wrought iron connected to beams by cast-iron fulcrums, and to each other by wrought-iron connections, to be operated by shaft connected to cross lever near center of car.

Materials, etc.—All materials, timber, forgings, castings, paints, etc., must be of the best quality, and all work must be done in a substantial and workmanlike manner, subject to such inspection and tests as shall satisfy an authorized agent of the N. Y., L. E. & W. R. R. Co., who shall have access at all proper times to the works, and whose decision shall be final.

Finish Inside of Car.—All bolt heads and nuts on inside of car must, where possible, be let in flush, and all sharp corners removed in order that they may not cut into or otherwise injure the merchandise.

Oiling and Packing Journal Boxes.—Journal boxes to be properly oiled and packed with good cotton waste, and furnished with suitable dust guards.

Bolts, Nuts, etc.—All screw threads, bolt heads and nuts must conform exactly to the car-builders' standard, known as the Franklin Institute or Seller's system.

Painting to consist of three coats of Prince's Metallic Brown, ground in best quality of boiled linseed oil, well put on. Numbering and lettering to be as directed by the Superintendent of Motive Power. The wood-work of trucks to be painted same color as body of car; all iron work of body and trucks to be painted black. The number of car to be stamped in each end of each truck bolster and each end of each body bolster, above truss rod washers, with 1-in. figures.

Weighing.—Each car to be weighed and the weight marked thereon.

Templates.—Contractors will be required to make use of such templates as the N. Y., L. E. & W. R. R. Co. may decide to furnish in order to secure interchangeability of parts. These templates to remain the property of the N. Y., L. E. & W. R. R. Co.,

and to be returned to the company when the cars have been turned out.

Variation from Specifications.—Bidders wishing to take advantage of special grades of material to suit their local market, must bring the question up at the time their bids are presented, with an explicit statement of the difference in cost per car which would be effected by the substitution of such material as is not in strict accordance with the specifications. Any proposition looking toward the use of material different from that specified will not be entertained after contracts have been executed.

Finish.—The drawings and specifications to be so construed as to finish the car complete in every respect and ready for service.

New England Railroad Club.

The regular meeting of the Club was held on Wednesday evening, Jan. 12. There was an unusually large attendance. The subject for discussion, as previously announced, was

CAR HEATING AND LIGHTING.

The President, Mr. J. W. Marden, referred to the recent accidents and loss of life on the Baltimore & Ohio and Boston & Albany roads, and hoped the discussion would lead to the adoption of some practicable way of preventing the burning of passenger cars when collisions occurred.

The Secretary read several letters upon the subject that had been received. One of these was from the Fort Dearborn Iron and Glass Co., which had a car heater so constructed that there was no danger of fire, and which had been tested by filling a car fitted up with it with shavings and other combustibles, then with the stove red hot, throwing the car at a speed of 40 miles an hour from an embankment 25 feet high, completely demolishing it, but showing no trace of fire.

Mr. Coleman suggested, as a passenger rather than a railroad man, that a train should be heated the same as a building, with large circulating pipes with branches leading off at suitable points, and if the engine could not spare the steam it should be furnished by a boiler in the baggage car. A car was nothing more than a long room, the heating of which should be from the outside.

Mr. Marden said that considerable attention had been given to the subject of steam heating on the Fitchburgh road. He thought there were many objections to the use of steam from the locomotive, and that it mattered little whether it was taken from this source or from a boiler in the baggage car. If we were to introduce any system by which cars are to be heated outside of themselves, our methods of operating railroads would have to be remodeled.

Mr. Lauder said that for absolute safety we must fall back upon the antiquated European methods, the warming-pan and hot water bags. In this country the stoves could only be superseded by hot water or steam. Hot water had been used successfully for many years, but taking steam from the locomotive was attended with many disadvantages. A good deal depended on the nature of the traffic. If a train can be made up solid, and started on a run of 24 hours, and there are no accidents, such as stalling in a snow bank, all will be well. But with a finely-divided local traffic, such as the roads running out of Boston have to handle, the system becomes almost out of the question. To attempt to take our heat from the locomotive would be almost ridiculous as well as utterly impossible. The hot-water system overcomes all these difficulties, although it may cause a fire in case the car is overturned. But he had never known one of these heaters to do this. If we were to use a special boiler in the baggage car, he did not wish to be pestered with a lot of patents covering a method which everybody had thought of long before. This baggage car usually occupies the most dangerous position in the train, and in case of accident would be most likely to be upset, and it is doubtful whether the safety of the train will be in any way assured by such a system.

Mr. Martin, of the Martin Anti-Fire Heater Co., said that he had made some experiments that he thought would be interesting, and before speaking of the system that he represented he would ask if the want of economy in the present methods used was not sufficient to warrant a change. It has been clearly shown by the train now running on the Boston & Albany, that with a small engine carrying 135 lbs. of steam, there is a great plenty to heat the train, and that, too, without any appreciable draft upon the boiler. The engineers say they cannot tell that they are using any steam; yet with this slight expense, work is being done that would be impossible with any water circulating heater in use. Not one of the latter kind can keep up a comfortable temperature in a train when the outside temperature is down to 10° or 15° below zero. It will be impossible to put in a heater with capacity enough to do the work required, and yet be able to regulate it on warm days. On the other hand, with the steam method, and with a low pressure of only 5 lbs. to the square inch, the cars are thoroughly warmed with all of the 26 ventilators wide open. As to the objection raised on the ground of difficulty of heating cars at way stations, might it not be well to consider if it would not be more economical to haul the car five miles farther at night and then by picking it up so much earlier in the morning it would be all warmed by the time it was to be used. All the prominent depots are heated with steam, and the cars standing there could be heated without any apparent cost, while with the present stove or water circulating apparatus the cost is from $30 to $50 per car each year. It would undoubtedly be the part of economy to turn a part of this money into steam-heating appliances for the various smaller depots. The other lay-off places are readily provided for, in that all prominent depots are heated by steam or ought to be, and so the connection can be readily made. In order to give perfect facility for controlling the heat in each car, separate branch pipes are led off from the main, and the car may be held at a uniform temperature of 70 degrees. The condensed water is all led into the trap and cars are running that have been upon the road for ten weeks without any adjustment having been made after the first setting. In zero weather a car would average a consumption of five gallons of water per hour, or 250 gallons for a five hours' run with a ten-car train, and as the tank holds 2,500 gallons, this is very inconsiderable. This applies to a car fifty-seven feet long. Four years ago a test car was equipped, and this has been running ever since and has not cost one cent for repairs, while the car has been kept at 70 degrees while the thermometer outside was down to 5 degrees below zero. Very recently cars have been equipped for the Boston & Albany, Chicago, Milwaukee & St. Paul and the Long Island roads. When a car becomes too warm the steam may be all shut off and what is already in the pipes retained there and the car be kept warm by radiation for from 30 to 60 minutes. He cited an accident that occurred on a train equipped with this heater a short time since. The train was derailed by the breaking of a switch-rod after the locomotive and baggage car had passed, sending the passenger coach down a side track, derailing the whole train, and tearing an old-fashioned cast-iron stove from its fastenings and hurling it across the car. The general manager expressed his opinion that the Martin heater had paid for itself, and a local paper stated that the accident was gotten up for the express purpose of demonstrating the safety of the device.

Mr. White was in favor of carrying the auxiliary boiler in a dummy between the tender and baggage car.

Mr. Emerson described the methods he had pursued upon the Connecticut River road. At first he put an auxiliary boiler in the baggage car, but this kept the baggage master in a continual stew and was unpopular. He then took all the steam from the engine, and now has a small boiler under each car connected with the locomotive, yet each having a separate fire. He had tried all forms of boiler for this place and had at last settled down upon the locomotive form as the best. He had even though of having iron cars as suggested at each end of a long train. With the present arrangement it is possible to start from Springfield on a run to St. Albans and return, with three or four hodfuls of coal, and have some left at the end of the trip. All sizes of piping had been experimented with, from 1 in. to 2 in., but 1¼ in. seems to be the best adapted to getting the best heating qualities; and when this is arranged with about 125 square feet of radiating surface to the car, hot and not cold cars will be the complaint. In fact it has been found necessary to run a coil of pipe around the deck on the roof to admit of keeping up the circulation and not heat the car. The water is turned into this pipe when the car is too warm. At Holyoke and at Northampton there is steam heat in the station, and at the latter place about 45 feet of steam hose is used to make the connection. At Holyoke regular connections are made. Steam is rapidly generated, and connections are made between the cars with a corrugated rubber hose, costing about 75 cents each, and of which about three will be used each season per car. The old Baker pipes can be used, but they are inconvenient, as they come too near the floor, and it is difficult cleaning around them.

Mr. Forney thought that, all things considered, the heater should be outside the car, and that the best place for it was underneath the car. Such heaters were in use on the Reading road, and if one large road can use this plan other roads can. It might not be the best, but it was a step in the right direction.

Mr. Adams thought that a heater under a car was in just the place to set the car on fire. There was nothing new in this plan. It had been tried and abandoned 25 years ago. Cast-iron stoves took the same rank. A train equipped with the Martin heater was the pleasantest train he had ever rode in.

Mr. Marden said the Fitchburg road was experimenting. The Westinghouse suspended heater seemed to be a good one, and it was undoubtedly better to have the heater under the car than in it. For in the latter case, when there is an accident the flame seems to flash the whole length of the car in an instant.

Mr. Folsom did not like steam heat and thought the stove was very much abused. In early days no one ever heard of a stove setting a car on fire. The first case of the kind was the Angola disaster in 1868; the next at Ashtabula in 1876. In Europe disasters are as bad as ours, but they have no fires, so, of course, the cars cannot be burned. The Reading heaters did not seem to him to be a success, as he had been almost stifled with coal gas on those cars.

Western Railway Club.

The regular meeting of this club was held in the Grand Pacific Hotel, Chicago, January 19. President Scott occupied the chair. There were 21 members and 7 visitors present.

Mr. G. W. Rhodes moved that a committee of three be appointed to report to this club the height of empty freight cars from center of draw-bar to top of rail of all roads represented in M. C. B. Association, together with the number of cars owned by each road; also of such roads as have signed the interchange rules.

The motion was supported by Messrs. Johnson and Scott and carried. The President appointed Messrs. Rhodes, Barr and Riley as the committee.

WEIGHT OF DRIVING WHEELS AND TIRES.

Mr. C. E. Smart, who proposed this subject for discussion was absent through sickness. A letter was read by the Secretary from Mr. John Hickey, Milwaukee, Lake Shore & Western, on the subject of heavy driving wheels, and taking the ground that much of the wear to tires and track arose from this cause.

President Scott had been investigating the subject and found that their three-inch tires were giving better milage per $\frac{1}{16}$ inch wear than the 4-inch tires in use. They are still investigating the subject, and hope to obtain more reliable data in course of time.

Mr. G. W. Rhodes said the report he made on wear of driving-wheel tires was from engines that had the same kind of wheel centers. He referred to an experiment made some years ago by the Pennsylvania Railroad with wrought iron and with cast iron wheel centers, and thought it would be interesting to learn what the results of the experiment were. Thought the weight of driving-wheels bore such a small proportion to the load upon them that it could not affect the wear.

Mr. John Mackenzie thought a mistake was made in the way record of tire wear was got. He was trying to get up an instrument that would show the wear of tire before it was sent into the shop. Wants to measure the wear every two or three months. There may be a great difference in wear at different periods.

President Scott said their road was not prepared to admit that as good mileage per $\frac{1}{16}$ inch wear could not be got from a 4-inch as from a 3-inch tire.

Mr. H. L. Cooper thought the kind of rail a tire was run on ought to be considered. All his engines have 4-inch tires, and he is collecting facts about their wear.

Mr. Allen Cooke had no statistics to offer, but thought a difference of 200 pounds in each wheel could not affect the wear of tires any. But they find that the middle wheels of their moguls wear fastest, which would seem to support Mr. Smart's views.

Mr. Mackenzie did not see that it would make any difference whether the weight was above the springs or below them. With his ten-wheel engines he found the wear greatest on the back drivers.

Mr. L. E. Johnson thought that the point which Mr. Hickey made about reduced wear resulting from a lighter driving wheel might be due to a better balanced wheel. Could not see where there was likely to be much saving from a lighter wheel center. Was disposed to agree with a previous speaker that it did not matter whether the weight was above or below the springs.

Mr. Angus Sinclair believed that it made a material difference placing the weight above the springs. It made the difference between the destructive force of a solid blow and the softened effect of a cushioned blow.

Mr. Wm. Barr had no data to offer, but believed that the question will never be settled by generalizing. We may theorize indefinitely, but if we want to know something definite about the subject, we must arrange experiments to cover the ground. We can take two engines and equip them, one with light wheels and the other with heavy ones, and subject them to the same conditions of service. We might learn something from this, but the result might be affected by other influences.

The discussion was postponed till next meeting.

RULES OF INTERCHANGE.

Mr. G. W. Rhodes opened the discussion on rules 12, 13 and 14, and a long talk ensued as to the best form of bills for repairs. Several chief clerks were present and Mr. W. Waggoner, of the P., C. & St. L.; Mr. Smith, of the C., C., C. & I., and Mr. Yates of the C., B. & Q. participated in the discussion. Several new forms of bills were recommended, and reasons given for their adoption, but finally the Club voted that the bill at present in use was satisfactory.

The only change recommended in the rules under discussion was to insert the clause "tread worn hollow" as a cause for rejecting defective wheels. The expression "worn flat" was criticised as being incorrect and a substitute was proposed but was not carried.

The following letter addressed to Mr. Verbryck was read:

FORT GRATIOT, Mich., Jan. 17, 1887.

DEAR SIR: Will you kindly decide the following?

A foreign road requests me to furnish eight oil boxes to replace others destroyed on one of our cars. I furnish them fitted up complete, for which I charge 2 cents per pound and 50 cents each for fitting up. The company receiving them declines to pay for fitting, claiming that the 2 cents should cover all charges according to M. C. B. rules. I think they are wrong, and know they are from the bills we have received in like instances, having been charged in every instance for such fittings and have always charged, never being disputed except in this instance.

THOMAS SUTHERLAND.

After some discussion, it appeared to be the sense of the meeting that the case was provided for by the section of the rules of interchange, which allows 20 cents an hour for labor. The lumped charge of 50 cts. was not considered correct.

The subjects for next meeting will be, 1st, Rules of Interchange, Nos. 15, 16, 17, 18, 19 and 20, to be introduced by Mr. Wm. Barr; 2d, Weight of driving-wheel centers and tires, to be introduced by Mr. C. E. Smart.

Master Car Builders' Club.

The regular meeting of the club was held at the rooms, 113 Liberty street, New York, the President, Mr. C. E. Garey, in the chair.

DEATH OF LEANDER GAREY.

The committee appointed at the last meeting to draft resolutions expressive of the feelings and sentiments of the club on the death of Leander Garey, its late President, reported the following:

Whereas, In the dispensations of an overruling Providence, our friend and associate, Leander Garey, has been removed from this life, and from his sphere of usefulness as the President of this club; and

Whereas, It is especially incumbent upon us, who have so long been favored with his companionship and valuable assistance in our efforts to advance the mechanical interests of railroads, to place upon our records an expression of our esteem for his character and of the affectionate regard with which his memory is cherished; therefore, be it

Resolved, That in the death of Leander Garey, this club has sustained a loss which its members feel with deep and heartfelt sorrow; and as a well deserved but inadequate tribute to his worth we desire to give formal expression, as we now do, to our high appreciation of his estimable personal qualities, his unswerving uprightness, his steadfast and disinterested friendship, his ability and singleness of purpose in the performance of arduous and responsible duties, the uniform urbanity and kindness which marked his intercourse with his fellow men, and his effective and persevering efforts in promoting the growth and usefulness of the Master Car Builders' Association, with which his name is prominently identified as its chief originator and for ten successive years its honored President, whose guidance was characterized by wise discretion, and to whose well considered counsel, always proffered without pretension, the prosperity of the Association has been largely due. These, and kindred traits of character exhibited in his life's labors, have won for him the esteem and confidence of all with whom he came in contact, and a permanent abiding place in the affections of the membership of this club. And, be it further

Resolved, That the members of the Master Car Builders' Club, in paying this feeble tribute to the memory of their late President and associate, do hereby extend to his family in the severity of their affliction our heartfelt sympathy and condolence, with the assurance that we are sharers with them in a mutual sorrow. And it is also

Resolved, That the President of this club be requested to furnish a copy of these resolutions to the family of the deceased.

On motion, the preamble and resolutions were unanimously adopted.

AUTOMATIC COUPLERS FOR FREIGHT CARS.

The President, in announcing the subject for discussion, remarked that the present meeting was not intended for an exhibition of individual couplers, but for the discussion in a general way of the merits of the different classes of these devices.

A number of letters from railroad men and others were read, relating mainly to the comparative advantages of tight and loose couplings, about which the writers give expression to much diversity of opinion. In the discussion which followed the reading of the letters,

Mr. Baker, of the D., L. & W. R. R., favored slack couplings. In his experience they had always given the best results.

Mr. Thurmond felt certain that as much slack can be given with a vertical plane coupler as with a link. The amount of slack must depend on circumstances.

Mr. Coope did not believe the question as between the link and pin and vertical plane coupler had yet been solved. He thought there should be an inch and a half slack between the draw-heads, that the link and pin coupling was more liable to break than a vertical plane.

Mr. Shinn said the brake tests at Burlington had brought out the fact that if continuous brakes were to be used, there was a necessity of less slack than the link and pin gives.

Mr. Smilie asked if the link and pin could not be made as strong as a vertical plane coupler.

Mr. Hine said, in starting your train, either with a close or a link and pin coupling, if the engineer cannot pull the train, he cannot back it. Whenever he slacks back he stores whatever power he has in his engine in his draw-bar springs. With the link coupler, when he goes to start, the draw-bar spring pushes the car until the spring has expended its force. Then the car stops. The engine then starts the car with a jerk. But if you have a close coupling the power is stored in the draw-bar spring; when he starts ahead the engine takes hold and keeps her going. While the weight of cars had been greatly increased, the strength of the link and pin had not been increased at all, nor could it be without changing the draw-bars. The link and pin was constantly breaking, but he did not know of a hook coupler that had been broken in pulling.

Mr. Garey thought the railroad companies should do something instead of waiting for somebody else to do it. There was certainly no lack of appliances.

Mr. McKeen thought it was a mistake to assume that there were hook couplers on the trains at Burlington. The links were only wedged up to take out the slack. Mr. Goodwin, of the Lehigh Valley road, had consented to have a test made on his road provided arrangements could be made for the purpose.

Mr. McNally wanted to know why link and pin couplers could not be made as strong or stronger than the vertical plane.

Mr. Hine said: You can make the link and pin just as strong as the vertical coupler, but you would have to make the rest of your coupler in proportion to your link and pin. If you did that you would have to keep those cars together, or in a short time your links will be lost, and your cars will be running with the old link and pin.

Mr. Shinn corrected his statement that tight couplings were used at Burlington. The statement had reference to some cars that was being fitted up for the coming tests.

Mr. Hine said the reason why the slack was taken out at Burlington was, that when they made emergency stops, running at a speed of thirty miles an hour, it piled everybody in the car in a heap. Some one suggested taking the slack out by putting iron wedges or blocks between the draw-bars, and they found that it lessened the shock 80 per cent. Then the question came up: That is all right, but can you start as many cars? Then they made the test as to the number of cars they could start with either the link or the hook coupler, and as a matter of fact they started one more car with a close coupler than they did with a link coupler, the conditions being the same.

Mr. McKeen: It has been stated to me that the slack was not all blocked out at the Burlington test, and not only that, but that they were not tried on a curve.

Mr. Hine: I did not say on a curve; on a straight track.

Mr. McKeen: There are both curves and grades on roads in our part of the country.

English and American Locomotives.

The relative merits of English and American loco motives, which has been occupying so much attention in the English press, has lately been discussed in a series of editorial articles that appeared in the *Mechanical World*, of Manchester, which were remarkable for their fairness, good sense and knowledge of the details of construction of the American locomotive. The writer takes the ground that if the American type of locomotive is better adapted for operating colonial railways than locomotives of the English type, it is the duty of British builders to supply their customers with the former style of engine. Mr. W. H. Booth, a well-known railway mechanical engineer who has had considerable experience in the locomotive department of railways in Australia, where English and American locomotives were working together, is editor of the *Mechanical World*, and the articles referred to no doubt represent his views. The following is the conclusion of the articles:

"From the foregoing it will appear that there is nothing in American locomotive practice differing greatly from the modern practice of our own stationary engine builders. It is not many years since gun-metal slide valves were common enough, or since eccentric straps were of the same metal or of wrought iron. All this has pretty well disappeared and we only find cast iron employed with safety and economy; but in locomotive practice we have adhered to the older rule, and therefore have been unable to reduce the cost of locomotives in the same ratio as first class stationary engines. In America both classes of work have run in parallel grooves, with corresponding advantage to the locomotive builder. It would have been impossible to convey in so few words a description of English locomotives which should as accurately describe general features as have sufficed in our brief description of the American engine. What we have said applies not only very largely to both goods and passenger engines, but also to the builds of different makers. In the one item of cylinders alone, while the whole of the American practice is combined in the words—outside, horizontal with top valve chests, English practice is ranging all over the field and includes every feasible inclination either up or down, inside or outside, with valve chests anywhere. To pull a train of 150 tons on the Midland Railway requires something very similar but still different from what is required on the Lancashire & Yorkshire or the North British. The Manchester, Sheffield & Lincolnshire again differ in slight particulars. The London & Northwestern and Great Northern differ again, and for their own traffic will use two different engines for the same train on different days. We have no uniformity in a country wherein no place is 1,000 miles from any other, and climate and general contour of country are equal. In America, over a territory vastly greater in distances and variations of climate, no such wide discrepancies of practice appear, and comparatively few classes cover the range of requirements. For main line work they have the four-coupled passenger engine of the "American" type, for heavier traffic the six-coupled "Mogul" type, and for heavy freight work the "Consolidation," or eight wheels coupled engine. American locomotives have been usually very poorly supplied in the matter of the foot plates. Very poor apologies for these are to be found, a mere shelf attached to the side of the boiler barrel being all that exists. Now, however, we are informed that more substantial plates are fitted, so as to render the duties of the engineer much safer than they have been. In this respect American builders may well take a lesson from English practice, which embodies foot plates of great width.

"In summing up the chief differences between the two types of locmotives which spring from the necessities of the two countries, it may be said that accessibility of parts and cheapness of construction play a great part in the comparison. Strictly speaking a correct comparison as attempted by most inventors is altogether out of the question, for their exists no sufficient grounds for comparison of the two machines as a whole, for their several environments are so different. The unsettled state of so great a portion of America has conduced greatly to the accessibility which marks the American engine, and accessibility has been well attained without unduly sacrificing important considerations unless in the respect of cylinder protection. For a cold climate the outside cylinders and valve chests of American engines are far too little protected from radiation and the cooling effect of the rapid rush of cold air at high speeds, and it is probable that to a very large extent this is the cause of that lack of economy in fuel consumption, which marks American practice. No English outside cylinder is so exposed as the American, and the valve chests are as well protected as those of inside connected engines. In the matter of the boiler, with the exception of the parts to which we have drawn attention, an American boiler presents little general difference from one of English construction; the use of cast iron wheels is the natural outcome of good cast iron and expensive forging, while the bar frame alone remains as a really distinctive feature, which, when properly designed, adds to vertical flexibility which is perhaps of greater importance than the lateral flexibility which the bar frame lacks. In American practice lateral flexibility is obtained rather by great freedom in axle boxes and the universal use of the bogie truck, single or double.

"American writers—despite the fact that so many American engineers could set them right—appear one and all to believe that this detail is purely American, and does not even exist in this country, where it was, as a fact, invented. Now the bogie truck is not a point of difference between the locomotives of the two countries at all. It is universal in America, because so few lines in America are wholly without sharp curves as to make it unadvisable for any locomotive to be without the bogie. Here, on the contrary, it is only within comparatively few years that bogies have come largely into use, and that they have done so is by no means because of their excellence on curves, but largely to reduce the weight on one small axle which the increase in the weight of engines had rendered, in the opinion of many engineers, excessive. The four-wheeled bogie, while adding greatly to the appearance of an engine, reduced the axle load of the leading wheels. Where the front end of an engine is light, however, it is quite a matter of doubt whether it is worth while adding to the useless non-tractive weight of an engine to the extent of an extra pair of wheels and all the other appurtenances of a bogie truck.

"The example of the London & Northwestern Railway, which is remarkable as being free from severe curvatures, and upon which run many of the fastest trains, is adducable as proof that the bogie is not a necessity excepting under the conditions which demand it, and have rendered its use almost imperative in America. It is, however, by no means necessary to safety on a straight line, and as merely the outcome of circumstances is no distinctive mark of American practice. In America it is used on goods engines as well as passenger, while here the easy curves and excellence of track render it unnecessary to use it on goods engines whose speed rarely exceeds 40 miles an hour.

"The use of wooden cabs very much closed in, of very light wheel-guards, of bells and molded sand boxes on the boiler crown, and flaring-out spark arrester funnels, with boiler sheathed in Russian iron, serve to give further peculiarity of appearance to the American production. The more solidly built English cab is, when fitted with double roof, far superior for tropical climates to any cab of wood. Such variations, however, as are embodied in the use of materials as cheap as those in America, and in more attention to accessibility of parts would, by suitable modification of frame and general design, enable the English locomotive builder to supply an engine at such prices as could not be touched by American constructors, while at the same time, combining with the good points of English, those of American practice also in such details as have made the American engine deservedly a favorite in the countries to which, but for the conservatism of English engineers, English work alone would, by preference, have gone by reason of its better finish and greater strength of build, especially in the matter of connections.

"We have endeavored in this series of articles to give a fair and impartial review of some of the differences observable in American practice which, it appears to us from our personal observations, may be factors in the success, to some extent, of American competition. That this exists is certain; that it may successfully be met is more certain, or America would not impose a tariff on English productions. That it will be met by English constructors depends upon their ability to learn by experience of the past, and from those whose opinions are entitled to at least some weight.

"The locomotive is so essentially the outcome of its environment that it is difficult, perhaps, for builders who are accustomed to first-class lines to appreciate the requirements of inferior unballasted roads.

"With a perfect road, by which we would suppose a straight continuously supported unjointed and unyielding rail of perfectly even surface and exact gauge, the best locomotive would be one without play in the axle-boxes or flanges, and with no springs, and just as far as the road falls short of perfection does the necessity for springs and for play, looseness and flexibility, generally make itself felt.

It would be well if writers generally on both sides of the water would clearly recognize the fact that a pound pressure of steam on a square inch of piston will exert identically the same force in any engine. The bell of an American engine or the enormous funnel does not add any thing to the tractive power of the steam in the cylinder, but dry rails in hot and dry weather do add very considerably to the effective adhesion of wheels, and this explains to a great extent the higher average adhesion noted in America over that to which we are accustomed here in our average moist weather. To some extent, of course, the free running qualities which distinguished the American engine add to its efficiency in traction, but this is limited only and due perhaps largely to the equalizing levers. The equalizing is carried to such an extent that in engines with single bogies, or pony trucks, the truck is equalized with the leading driver. In the matter of coal consumption, American practice is somewhat behind. The want of economy noticeable may be largely due to the unprotected cylinders—this point we have already noted—and to the lack of accurate fitting about the damper doors and ash-pan which robs this important adjunct of much of its usefulness to the driver. The obstruction caused by spark arresters too has to answer for part of this fault. Spark arresters are undoubtedly an obstruction and as such undesirable, though we once knew a locomotive superintendant to discharge a draughtsman who ventured to intimate that such was the case. Spark arresters of undoubted efficiency must be employed over a great portion of the American continent, in summer time at all events. We have not by us any information as to whether in winter or wet weather any provision is made for dispensing with this serious obstruction."

The Locomotive Works of H. K. Porter & Co.

As is well known, the proprietors of these works make a specialty of building light locomotives, and they have got their business worked up on a good manufacturing basis. The company have built upwards of 800 locomotives, and in that number they have probably had a greater variety of shapes and sizes than anything ever turned out of a shop devoted to locomotive building. The variety in the shapes and sizes of engines ordered from the Porter company has its decided drawbacks, for it is almost impossible to arrange their machines according to standard types, which does so much to facilitate and cheapen production, but Mr. H. N. Sprague exercises great ingenuity in applying standard pieces to engines that are very dissimilar in size and outline. The gauges to which the locomotives have been built are of infinite variety, but it often happens that the leading difference between a narrow and a wide gauge engine, besides the distance between wheels, is in the cylinder saddle and in the deck plate. A great many of these engines are sent to coal pits, iron works, and short roads where there is no machine shop, and the company is constantly required to supply the material needed for repairs, so they have to make every part interchangeable. A considerable portion of the work done by the shop consists of finishing material to repair engines they have built, and the pieces sent out almost invariably fit without change.

They test on rollers all the engines built before sending them out, and in this way run them up to a high speed.

They use a special form of milling machine for finishing links, link blocks and other radial work. It is an adaptation of a machine long used in armories for forming musket stocks. The links are all made of a low grade of steel that can be case-hardened, and it is said to make a much better job than iron, there never being any of the surface cracks so often found in case-hardened iron. Case-hardening is done in the gas furnace during the night and costs almost nothing. The case is put in before quitting time, and when the blacksmith having charge of that operation gets to the shop in the morning, the work is ready for dipping, and does not interfere with the use of the furnace. All the pins in movable parts are hardened, besides the guides, links and various other parts. They put a hardened bush over the link stud, letting the wear of the hanger come upon the bush. When the part gets worn a new bush only is needed instead of a new saddle, as in the case where the wear is on the stud. This would be a good arrangement to introduce for large locomotives. The blocks on top and bottom of all links are put in with parallel faces to simplify closing.

Threaded reamers are used exclusively here and are highly spoken of. The machinist who originally patented the threaded reamer worked in this shop when the plan was first tried. They use a great many jigs to aid in duplicating operations, their light work being very suitable for the application of such labor saving devices. An attachment to a universal milling machine is used to operate a thin emery wheel which they use to sharpen the slot of taps and reamers. The same machine is employed to run a saw for cutting the slot in the brass tube that is used as an edging for wheel covers. Grinding is employed to a great extent for finishing work, seven men being employed in the room devoted to grinding apparatus. One can spend a very pleasant day in these works with Mr. Sprague, the able superintendent.

THE Wagner Sleeping Car Company's shops at Buffalo, which are now under the able management of Mr. T. A. Bissell, are busy rebuilding and effecting heavy repairs on the old rolling stock belonging to the company. They are getting out plans for several new cars that will be among the finest sleeping cars ever built. They are also preparing drawings of a new private car for the use of President Webb.

HICKEY SNOW FLANGER.

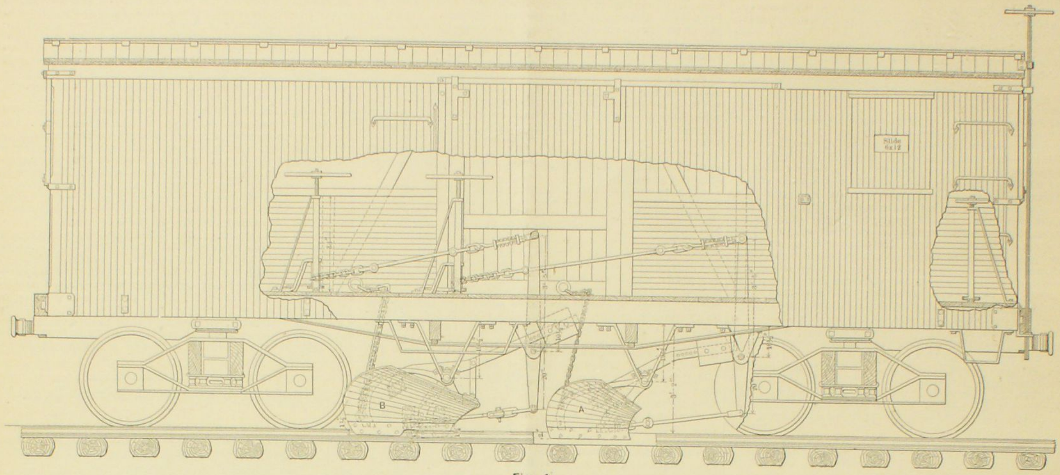


Fig. 1.

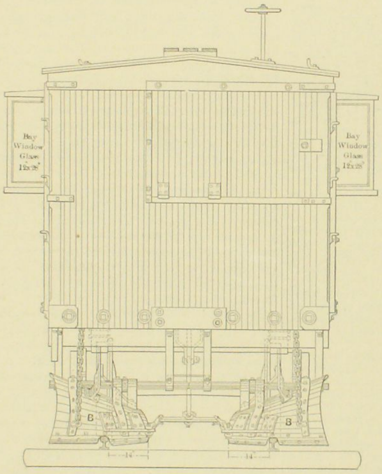


Fig. 2.

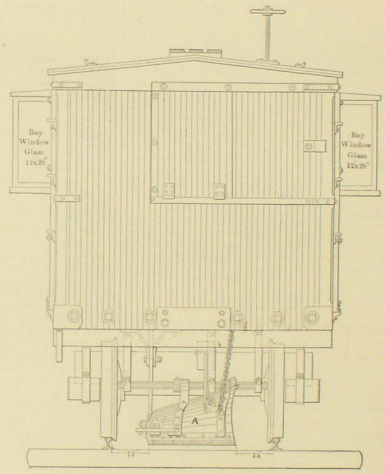


Fig. 3.

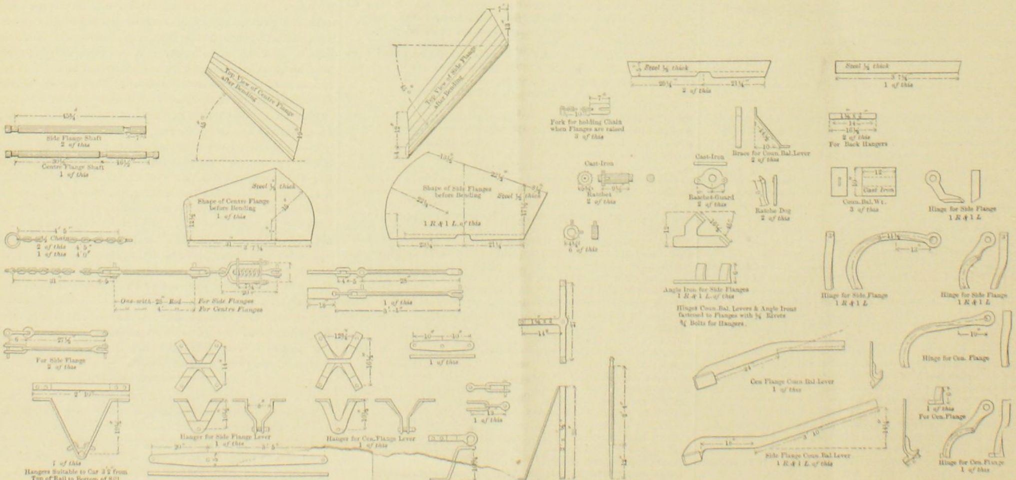


Fig. 4.

Hickey Snow Flanger.

The following description of the snow flanger shown in the engravings has been sent to us by Mr. John Hickey, the designer. There is no patent on the device.

As you are aware, perhaps, we have to give the displacement of snow in this climate special attention during at least three months of the year.

The manner of construction and mode of attaching to box cars is plainly shown on drawings. Fig. 1 is a side view showing side and center flangers, also attachments inside of car for raising and lowering same. Fig 2 is an end view showing the two side flangers, independent of center flanger. Fig. 3 is a back end view of center flanger, and Fig. 4 shows details of all.

The center flangers, you will notice, are located some little distance ahead of the side ones, and are placed at an angle of 45° to the rail. It may be let down below the rail any distance desired. It takes the snow from center between rails and throws it a distance proportionate to speed run. The side flanger cleans the track 14 inches inside and 18 inches outside of rail, and is let down 2½ inches inside and 1½ outside the rail, being held in this position and run at a speed of 20 miles an hour. They will clean the track of all ice and snow and throw it 50 feet.

Flanging 12 or 14 inches inside of rails has been in use for years, but when in connection with this we take the snow for 18 inches outside, and through means of the center flanger the entire space between the rails is kept clear of snow. Simply flanging inside the rail leaves a channel that is rapidly filled in with drifting snow; whereas the snow being taken from the entire distance between rails and outside, it leaves the track in such condition that immediate drifting has not much effect.

We have reached this mode of flanging after years of experience, and for the last three years it has been doing excellent work on this road. We have two men on the inside to operate, and usually run it in connection with snow-plow. We use bay windows on sides of car, so the men who operate it may see when to lower and raise the machinery. We use springs for the holding down process, in order that the action on the ground may be elastic, but couterweights are used for raising, as we find them much more reliable than springs.

Master Car & Locomotive Painters' Association.

Mr. Robert McKeon, the Secretary of the association, has issued the following circular:

The following programme of questions for consideration at the next convention has been approved by the Advisory Committee, and the President has appointed the committees as named below. Each subject is worthy of a careful study, and time is given for practical experiment before the meeting in New York.

No. 1. It is generally admitted that scarcely two samples of Japan of different manufacture will give like results as to drying and binding qualities. Why should there be such a variation, and why can we not have a standard of specifications as to drying and binding? In what way shall such a standard for Japan be determined? W. T. Ledford, Richmond & Danville, Richmond, Va.; B. Stanbury, Union Pacific, Omaha, Neb.; Alex. Campbell, Manhattan Elevated, New York.

No. 2. Does the addition of Japan to raw linseed oil retard its drying if used in excessive quantities, and what variation is there in the drying qualities of Japans, when mixed with raw linseed oil? M. W. Stines, Barney & Smith Manufacturing Co., Dayton, O.; A. E. Barker, Chicago & Northwestern, Chicago; R. W. Scott, Canadian Pacific, Montreal.

No. 3. What is the maximum of Japan that can be used with safety, and the proportion to raw linseed oil? Jos. J. Murphy, Louisville & Nashville, Louisville, Ky.; H. L. Libby, Charles River Street Railroad, Boston; Wm. E. Hibbard, Boston & Albany, Allston, Mass.

No. 4. What quantity of oil paint, composed of metallic paint, linseed oil and Japan, should constitute a good coat to the square yard of surface? Amount in weight and also measure. F. S. Ball, Pennsylvania, Altoona, Pa.; M. L. Sims, East Tennessee, Virginia & Georgia, Atlanta, Ga.

No. 5. Would it be more economical for the painter to manufacture his own Japan, or continue to use that of the manufacturer? George O. Widner, Lake Shore & Michigan Southern, Buffalo, N. Y.; H. M. Billings, Pittsburgh, Cincinnati & St. Louis, Columbus, O

No. 6. Management of the Railway Paint Shop. E. L. Bigelow, Baltimore & Ohio, Baltimore.

No. 7. What constitutes the best priming coat of paint for locomotives and tanks? Jno. S. Atwater, Hinckley Locomotive Works, Boston; F. M. Widner, New York, Lake Erie & Western, Buffalo, N. Y.; C. C. Wood, Geneva, Ithaca & Sayre, Sayre, Pa.

No. 8. What is the best method of mixing and grinding car body colors to insure the greatest durability? Jacob Hoesly, Pennsylvania, Meadow Shops, N. J.; Robert McKeon, New York, Pennsylvania & Ohio, Kent, O.; John Rattenbury, Chicago, Rock Island & Pacific, Chicago.

No. 9. Causes of iron rusting under the priming coat of paint, and the effect rust has on paint. A. J. Bishop, Cleveland, Columbus, Cincinnati & Indianapolis, Delaware, O.; C. C. Young, Chicago, Rock Island & Pacific, Trenton, Mo.

No. 10. Is it advisable to paint the inside (water space) of an engine tank to protect it, and what material would you consider it best to use? L. W. Smith, Cleveland & Pittsburgh, Wellsville, O.; E. E. Earl, Northern Pacific, St. Paul, Minn.

By resolution passed at the last convention in Chicago, each member is requested to prepare three panels, one each of tuscan red, straw color and olive brown, according to their own formula, expose them to the weather, and report results in writing at the next convention.

On questions Nos. 1, 2 and 3 a regular committee has been appointed, but the Advisory Committee would recommend that all members make practical experiments, keeping a record of them as made, and report results in writing at the next meeting, and in carrying out the experiments they would suggest the following tests: Mix raw linseed oil and turpentine Japan, varying the proportion of oil from 2 to 20 parts to 1 part Japan, which would give 19 different mixtures. These should be spread on as many pieces of glass or non-absorbent surface, and submitted to a temperatue of 120 degrees Fahrenheit, noting length of time required for each to dry. The result of these tests would be highly satisfactory and much definite information obtained, and by having all the members engaged in the test, it would cover nearly all the reputable Japans in the market and would include many qualities of linseed oil.

Any member unable to serve on the regularly appointed committees should notify the Secretary at an early date so that their places may be filled.

Communications.

The Relations of Employers and Employes.

Editors National Car and Locomotive Builder:

It is to be regretted that the managers and chief officers of railroads and great manufacturing establishments do not cultivate a closer intimacy with the lower grades of their employés, instead of holding themselves aloof and widening the existing gulf between labor and capital. The workingman to-day, especially those who make up the large class of skilled mechanics, are becoming educated to a higher standard of intelligence, which entitles them to greater social recognition than has hitherto been accorded to them. Mechanics who constitute the great army of employés in the mechanical departments of railroads, especially shop foremen and others who hold positions of responsibility, are peculiarly sensitive to apparent neglect, as well as to every word or token of kindly appreciation. I can not but think that this prevailing trait in human nature is not as well understood by railroad officials as it might be, and that a more general recognition of it would be of great mutual advantage to the interests of employers and employed, and would do much toward obliterating the apparent antagonism between capital and labor. So far as my own observation goes, railroad mechanics, as distinguished from the lower grades of employés, seem to be farther away from the head officials than are trackmen, conductors and others upon whom awards of merit are frequently bestowed. Such awards may be of trifling importance as a matter of dollars and cents, but they are a great stimulus to increased diligence. They are an evidence that the toiling workman is not forgotten, and have a good effect in strengthening the ties between the upper and lower strata of the masses engaged in operating railroads and carrying on our diversified collateral industries. The day has passed when intimidation and the fear of losing situations are productive of the best results; but I do not hesitate to say, as a railroad mechanic who has an opportunity of knowing the feelings and sentiments of my associates, that if the higher railroad officials would condescend to mingle a little more freely with their employés and extend to them more frequent tokens of recognition and fellowship, it would turn out to be, in the long run, a highly profitable investment. MECHANIC.

[Our correspondent complains of a grievance which thousands of others feel, no doubt, as keenly as he does. But he deals with the subject a little too exclusively from his own individual stand-point. Let us take a broader view of the matter. In order to concentrate the requisite capital, great enterprises such as railroads and large manufacturing establishments have to be carried on by corporate machinery, without which our industrial progress would be slow indeed, and the millions of "workingmen," so called, would be in danger of starvation. The capital invested in these enterprises is contributed by all sorts of people, both rich and poor, and the ownership of the property represented by the stock is constantly changing as one stockholder sells his shares and another buys. The stockholders collectively can not operate a railroad or run a big factory, but must delegate the controlling power to a board of directors, who in their turn provide for the appointment of a manager, superintendent and so on, who are each in their respective spheres employés of the stockholders, and, as a rule, they are the very hardest kind of workingmen, to say nothing of the responsibility they have to assume, and which is far heavier than that which rests upon a shop foreman or other class of employés. They must also have the requisite capacity acquired by climbing from the foot of the ladder of promotion, at the top of which there is always plenty of room. It is a well-known axiom that there is no friendship in business, nor is there any social equality, as such. There are "classes" in this country as in every other country where there is inequality of human condition. This may be denied theoretically, but it is none the less true; and no amount of querulous complaining can make it otherwise.—EDS. N. C. & L. B.]

Questions About Locomotives.

Editors National Car and Locomotive Builder:

In reading your very interesting article on page 157 of your paper for December, I was not quite clear in my mind whether, when the throw of the eccentrics was changed, if the valves were changed also, and others of different lap substituted, such as one would naturally use with the longer travel. Please let me know in your next issue.

I admire your article in January number on exhaust nozzles and the indicator, which I feel is calculated to do much good among the fraternity.

When you refer to the logy engine with low nozzles, I fear you made a mistake about the lap of valve being ⅛ inch.

Now, I would like to have you explain to us readers how it is that you can use a 4-inch single nozzle when you can use only 2½ when there are two nozzles employed. We are all aware that when an engine is working in good condition, there is but one exhaust passing through the 4-inch single nozzle at one time; and when at slow speed, such as prevail with the locomotives working on mountain grades, in hauling coal, etc., there is quite a space of time between the release of steam from each cylinder, yet the engines make steam freely with a large single nozzle. Now be good enough to give us a good plain explanation of this thing, as I know you can, and at the same time be doing something for the good of all that are interested in the locomotive. I think this has never been done by any one as yet.

The improvement in your paper is such as any one has reason to be proud of. I hope you will continue in the same good cause. HENRY F. COLVIN.

[*Answers.*—1. No change was made on the valves, but the engines were worked at the same point of cut-off, that having been managed by the quadrants. In one case, a new quadrant was put on that the same point of cut-off might be maintained.

2. In the article referred to, the word inside was by mistake omitted. It should have read ⅛ inch inside lap. Of course, the omission ruined the point of the paragraph.

3. There is only one explanation possible to the question raised by the relative sizes of single and double nozzles. The single nozzle, by ejecting the steam centrally through the stack, produces the required draft with a low steam velocity. Double nozzles send the steam up the side of the stack, and have to be contracted so that the steam shall escape at a higher pressure to effect the same rarefication on the gases in the smoke-box. This is not a mere theory, it is the answer given by experiments with nozzles of different forms and sizes. The injectors which Mr. Colvin makes ought to corroborate this view of the matter.—EDS. N. C. AND L. B.]

Use of the Indicator. Compounding.

Editors National Car and Locomotive Builder:

I have read with great interest the articles, "Information from Indicators," and "Have we a Field for Compound Locomotives," in your last issue. There is more benefit to be derived from a judicious use of the indicator than some people believe. The chief engineer of nearly all steamships is supplied with one, and as a general thing has to take diagrams every voyage and include the results in his reports. By this means he is enabled to detect the slightest defects due to wear or other causes, and correct them by proper readjustment. Yet on railroads the indicator is rarely applied, and indeed some master mechanics "do not believe in it."

I was much impressed by the advantage to be gained by the use of the indicator a few years ago while making some experiments with a compressed air locomotive in New York city, and especially with one on the elevated railway. During a trip over the road with three cars, and making all stops, the storage pressure fell from 600 lbs. to 150 lbs. per square inch. The indicator was afterwards applied, and revealed some slight defects in the distribution, which were corrected; and then a trip was made with four cars, while the storage pressure only fell from 600 lbs. to 195 lbs., the difference being entirely due to a very slight readjustment of the valve gear, which would not have been considered important in a steam engine. I strongly suspect that in some cases, when an engine is said to be a "bad steamer," the fault is more with the adjustment than with the boiler, and I think it would be both interesting and edifying in such cases to test the evaporative power of the boiler, and compare it with another of the same class.

As to working the steam expansively, this can only be done with advantage up to a certain limit, owing to cylinder condensation. But I believe that limit is far beyond what is possible with a single valve operated by the ordinary link motion, even without compounding. And here I would venture the opinion that the advantage to be gained by compounding a locomotive will not compensate for the complication involved, though it would be interesting to see it demonstrated by experiment more fully than has been done. But this will be further referred to.

It is claimed by some that a sharp exhaust is necessary to keep up the fire and maintain a full head of steam; but if the steam is used more economically the fire need not burn so fiercely, and it is a nice point, yet to be determined so far as I know, just to what extent the steam may be used expansively and still give sufficient draft to the fire. Certainly it is useless to talk of compounding if the sharp blast now common to locomotive engines is all necessary. But who is going to spend the time and money necessary to make the test?

The first step toward such a test is to fit a few engines with some simple cut-off valve-gear. I know cut-off valves have been tried and abandoned, but this need by no means be regarded as conclusive evidence of failure, and doubtless more improved apparatus can now be selected.

I used an extremely simple and efficient device on one of the air motros designed by me.

The various points of cut-off were manipulated by the reverse lever as now, except that the highest grade (⅛) was obtained when reverse lever was "down in the corner," and the later grades as it was "hooked up." This gave the additional advantage of free and correct exhaust.

I have already expressed doubts of the benefits of compounding. The only effect of this is to reduce cylinder condensation with excessive expansion, and is carrying the same principle a little farther, which led Watt to apply a separate condenser instead of injecting cold water into the cylinder itself; but to get the full advantage of it we should have jacketed cylinders, condensers, air pumps, etc., which are not permissible upon wheels. Without these I think the advantage would be small and would not warrant the complication. Rather use slightly larger cylinders as now arranged, and apply a separate cut-off valve.

There is a tendency at present to use excessively high pressures. I have made careful experiments with compressed air, using all initial pressures from 400 lbs. to 100 lbs. to square inch, and expanding to all final pressures down to atmospheric pressure at the point of exhaust, and found that the theoretical gain could not be even approximated above 130 to 140 lbs. per square inch. This being so, I adopted these pressures for the cylinders, and used a reducing valve, there being nothing gained by straining the machinery.

Colonel Beaumont, in London, used all initial pressures from 1,000 lbs. down, in a compound engine with similar practical results, and the little steamer "Anthracite," built by Loftus Perkins, of London, carried 500 lbs. steam expanded in three cylinders with cut-off valves, which gave very small practical results; so small, that a board of naval engineers, appointed to make some tests with her at the Brooklyn navy yard, reported adversely.

Trusting that this may lead to a discussion of these matters to the end that good may come,

I am, yours truly, ROBERT HARDIE,
Supt. New York Locomotive Works.

ROME, N. Y., Jan. 17, 1887.

Chicago Milwaukee & St. Paul Locomotives.

Editors National Car and Locomotive Builder:

Your January number contains an article commenting on and comparing the engines of the Chicago, Milwaukee & St. Paul and the Chicago & Northwestern roads.

Your figures are probably correct, but the comparison is not, and any one familiar with the power of the two roads will recognize this. There are reasons why the engines of the St. Paul should show a larger operating expense than those of the C. & N. W. in fuel, wages and repairs. It is true we have all makes of engines, and what great railroad system has not, that is made up of small roads absorbed here and there, each with its own style of power. The C., M. & St. P. has its standard forms of engines for each service, and they are not deficient in heating surface. The standard freight engine is the ten-wheel, 19 × 26 cylinders, five-foot drivers, extension front. There are a great many of these, and on many divisions they are the only freight engine. It is these in my belief that make our report appear so high. Engineers and firemen on ten-wheel engines receive extra pay, amounting to 0.40 cent per mile. The heavy trains hauled at high speed (there being but little restriction to the speed of freight trains) call for fuel, and a heavy engine requires more expensive repairs than a light one. But is this not compensated for in the greater tonnage hauled? Else, where is the economy in large engines. It is not to be expected that these engines can be run with the same quantity of fuel, stores and repairs as the lighter engines of the C. & N. W., which has but few heavy engines of this class, so few that there is no allowance in their pay schedule for running or firing this class of engines.

No doubt there is room for improvement with us, the perfect engine and the perfect man to run it are yet to be developed. But take into consideration the engines of the two roads, and our record is not as bad as it looks, is the opinion of a ST. PAUL ENGINEER.

The Wear of Brake Shoes.

Editors National Car and Locomotive Builder:

I notice that your correspondent "M," in your last issue, does not like my idea as set forth in your December number, that the number of miles which a train runs has nothing to do with the cost of wear of brake shoes. He reasons that the records of wheels, journal bearings, etc., are not kept in this way, and can see no reason why the wear of brake shoes should be shown in a different way.

Now, I would ask why the expense of brake shoes should be classed with that of wheels? The depreciation of wheels goes on continuously as the wheels are run, but that of brake shoes only at such times as they are put to work. So far as my own experience goes, I think it is impracticable to attempt a record of the wear of brake shoes under freight trains, as the shoe may be worn completely out and replaced one or more times while the car is away from the road which owns it.

I am aware that the shoe is used more or less on down grades and at grade crossings to keep the train under control, and is used in this way more on freight trains than on passenger trains. On trains using hand brakes, a few cars in a section of the train are "set up" when going down steep grades, or another train with power brakes may use them to retard the speed for the same or other causes. But the actual purpose and use of the shoe is to bring the train to a stop.

Now, a train may make twenty stops in a thousand miles, while another makes 500 stops in the same distance; and while one train may give a cost of about 18 cents, the other would give a cost of twenty-five times as much, therefore I say the number of miles run shows nothing.

In my way of thinking, you want a record of the work done in all cases of tests, and the number of miles run by the car does not show the amount of work performed by the shoe. D. W. H.

Locomotive Performance in Florida.

Editors National Car and Locomotive Builder:

The communication of Mr. E. A. Campbell, of the Houston East & West Texas road, published in your January issue, leads me to presume that a few items from this end of the country concerning the "soon-must-go" narrow-gauge system may also be of interest to some of your readers.

Mr. Campbell's letter was the more interesting to me from the fact that the road with which I am connected (the Jacksonville, St. Augustine & Halifax River division of the Jacksonville, Tampa & Key West railway) is similar to his road, being 3 ft. gauge and uses wood for fuel; and as he challenges any one to produce a better record in fuel consumption, I will proceed to do so by quoting from our performance sheet for the year 1886.

Our engines are 11 × 16, 12 × 16" and 13 × 20" Grant, and 14 × 18" Baldwin, with 48" drivers. The average miles run per cord of wood was 85.99; per pint of lubricating oil, 32.11; per pint valve oil, 52.76. Average cost per train mile for fuel, oil and waste (excepting wipers) 2.81 cts.; total average cost (fuel, wages and repairs included) per engine mile, 9.62 cts.; per car mile, 1.68 cts. The two latter figures also include the cost of general repairs on one engine, which was in shop seven months during the year.

Our freight trains average about twelve cars all the year the passenger about three cars in summer and five in the winter. The following figures are from our performance sheet for last December: Average miles run per cord of wood, 117.33; per pint lubricating oil 48.48; per pint valve oil 99.99. Cost of fuel and supplies, 2.07 cts. per train mile. One passenger engine averaged for December 133.49 miles per cord of wood, hauling three cars.

So far as I have any record as to tire wear, one engine has run over 50,000 miles after first turning, and will probably make 5,000 or 6,000 more.

I may add that our wood is usually very good Florida "fat" pine, cut 2 ft long, at $2.25 per cord. The engines carry no sand, a kind Providence distributing it mor evenly on the rails than by use of the sand-lever, but we are obliged to get more than is wanted in car journal boxes.

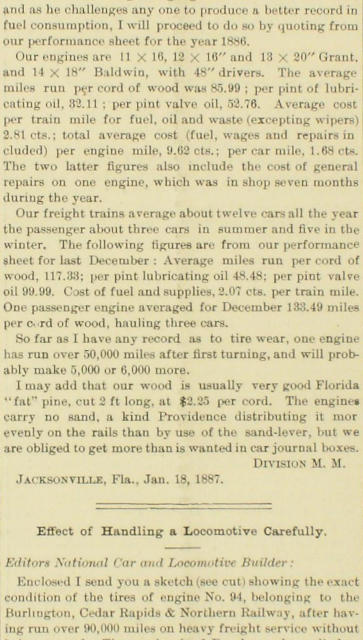
DIVISION M. M.

JACKSONVILLE, Fla., Jan. 18, 1887.

Effect of Handling a Locomotive Carefully.

Editors National Car and Locomotive Builder:

Enclosed I send you a sketch (see cut) showing the exact condition of the tires of engine No. 94, belonging to the Burlington, Cedar Rapids & Northern Railway, after having run over 90,000 miles on heavy freight service without being turned. The engine is of Brooks make, cylinders



18 × 24 inches, six wheels connected and a four-wheel leading truck. Most of the work done by the engine was on a short division between Cedar Rapids and West Liberty, where the track is constantly rising and falling, some of the grades being long and steep. The engine has been run constantly by Mr. M. W. Carey, who informs me that he pulls 24 cars one way and 27 cars the other, and he generally has a full train. During the time the engine has been in service since received from the builder the piston rods have been trued up once and glands bushed, the diameter of the piston rods having been reduced $\frac{1}{32}$ inch. The packing used is hemp or soapstone. The guides have been closed once, and the rods taken down and the brasses filed once. Owing to the bad water used on the road, our freight engines seldom run more than 30,000 miles before the flues have to be removed and the boiler cleaned, but the flues have been moved out of the 94 only once, and at that time it was not found necessary to remove more than a few in the middle of the flue sheet, where there was some leakage. The fire-box is almost as free from leakage as the day the engine left the shop.

Now these very satisfactory results are got from one of the *thinking* class of engineers. He takes a pride in keeping his engine in first-class condition, and uses his head to find out how that can best be brought about. He does not use sand unless compelled to, and then only in small quantities, a plan which saves the tires. He does not believe in pumping up hill and down dale, but uses his injectors so that when he reaches the top of a hill he has three gauges of water, so that when the engine's head drops down the hill, there is no fear of the crown-sheet being left dry, and it is not necessary to flood the boiler with cold water going down the hill. I think this has a great deal to do with the fire-box remaining so long free from leaks.

Carey also makes good use of the deflector plate in the smoke-box. This deflector is operated by a rod from the cab, and the intention is to regulate the draft by it, but very few engineers trouble themselves to use it. When the steam is getting up and liable to blow off, Carey drops the deflector down besides closing his dampers. As you are aware, the usual way to check the rise of steam is to throw open the fire door. When the fire of this engine is dumped at night, Carey sees that the dampers are closed, and that the deflector is dropped as close to the flue sheet as it will go. By this means the cold air is restrained from rushing through the fire-box and flues, and cooling goes on so slowly that after standing seven or eight hours the engine generally has some steam when firing-up time comes round. The engine has been running nearly three years. ALLAN McDUFF.

[Engineer Carey, referred to in this letter, was a fireman on the road mentioned when Angus Sinclair was taking notes for his book on locomotive engine running, and Carey is described on page 55 as the model fireman. As a natural sequent, he has become a model engineer.—EDS. N. C. AND L. B.]

"Deadeners" for Car Floors.

Editors National Car and Locomotive Builder:

There could be no great objection to putting shop shavings into the floor and wall spaces of passenger cars, were it not for the fact that they are liable sooner or later to aid in starting a fire which will roast or suffocate people who are caught between the seats in a smash-up. On the other hand, there can be no good excuse for the continued use of shavings for deadening, when the fire-proof insulator, mineral wool, has been successfully used in cars by some builders for several year past, both for retaining heat and deadening sound. Telescoping collisions, letting loose the shavings, upsetting the stoves, and pinioning passengers by the legs, all occur in instant. The shavings ignite just as quickly, and the whole car is in a blaze. The two calamities, collision and fire, are combined in one, and the blame laid on the engineer or switchman, when in justice it should be shared by the car-builder, or others of a higher grade in the service. As an insulator, mineral wool is about forty per cent. better than shavings. If its use as a car lining was an unprofitable expenditure, it could even then be employed to advantage, for not only will the saving in cost of fuel for car heating repay for the outlay many times during the life of a car, but if only one car out of five hundred is saved by it from burning, the value of the car thus saved will compensate for the introduction of this incombustible substance in all of them. Two results will attend its use in car floors. It will resist sudden fire attack, and only a small fire will be needed for heating, the extraction of the heat being reduced to a minimum.

R. D. A. PARROTT,
1,507 Broadway, New York.

Don't Like the Extension Front.

J. H. M., a correspondent in Indianapolis, takes us very severely to task for encouraging the "foolishness" of extension smoke boxes for locomotives, and wants to attack certain master mechanics through our columns for having adopted the extension front. While suppressing the letter, we would like to suggest to J. H. M. that the men he calls fools may have had good, well considered reasons for the changes they made on their locomotives, and that the "blind prejudice" may be with the man who assails the motives of his neighbors. We would also rise to remark that abusing a man for adopting a device does not convey prima facie evidence that the device is devoid of merit.

A list of queries about certain engines is given, the concluding question being: "What good has the extension smoke-arch ever done to help offset its bad qualities?" As an answer to that we would venture to say that where the extension front is properly adjusted for the engines to which it is applied, it retains the sparks that come through the flues. That is a better place for them than the dry grass of the prairie or forest.

NATIONAL CAR AND LOCOMOTIVE BUILDER

PUBLISHED MONTHLY

BY

R. M. VAN ARSDALE.

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EDITORIAL ANNOUNCEMENTS.

Advertisements.—*Nothing will be inserted in this journal for pay,* EXCEPT IN THE ADVERTISING COLUMNS. *The editorial department will contain our own views and opinions; and the rest of the reading matter, aside from advertisements, will be such as we consider of interest to our readers.*

Contributions.—*Articles relating to railway rolling stock, construction and management, and kindred topics, by those who are practically acquainted with these subjects, are especially desired. Also early notices of changes in railroad officers, organizations and names of companies.*

Special Notice.—*As the* CAR AND LOCOMOTIVE BUILDER *is printed and ready for mailing on the last day of the month, advertisements, correspondence, etc., intended for insertion, must be received not later than the 25th day of each month.*

Economy of Steam.

The letter published in another column from Mr. Robert Hardie, Superintendent of the New York Locomotive Works, is a timely contribution on subjects that are attracting the attention of all progressive railroad engineers. Mr. Hardie is one of the best authorities in this country on steam engineering, and his opinions are entitled to the greatest consideration. The incident which he mentions, where the indicator pointed out a defect that was causing serious loss of power, could no doubt be paralleled daily with steam locomotives, if the indicator received the regular application that the importance of its revelations entitles it to. Where competition is carried to the extremity that has prevailed with steamboat lines, nearly obliterating all profits of transportation, coal saving must be practiced as a means of self preservation; and in that case the indicator is systematically employed as a means of detecting waste, and stopping every source of loss where stoppage is possible. It looks as if still closer competition in railroad business, with reduced margin for operating expenses, were necessary to induce the ordinary run of railroad officers to resort to the refinements in engineering represented by the use of the indicator. That much useless waste now prevails is certain, and that the time will come when it must be stopped is also a foregone conclusion.

Mr. Hardie has had long experience in marine engine work, and his opinion on the question of compound locomotives is worthy of serious consideration, but it is a subject where diametrically opposite views are held by the ablest engineers in Europe, and the reported results in practice are conflicting. So we prefer to remain neutral until the evidence on one side or the other is more complete than it is at present. We think, however, that our correspondent does not state the whole case in favor of compounding when he says its only effect is to reduce cylinder condensation. There is no doubt prevention of loss of heat from condensation, when, by compounding, wide extremes of temperature are prevented in one cylinder; but there is good reason for believing that considerable service is performed by the low pressure cylinder in the interest of economy in utilizing the energy of the steam re-evaporated at the end of the stroke of the initial cylinder. This is at least the opinion of Isherwood, who is the best authority on the subject in this country. The cylinders act very much like a condenser on the steam entering them, and in many cases there is enormous loss of effect from this cause.

When the steam enters the cylinder it goes into a relatively cold vessel, and saturated steam being constantly on the dew point, part of it becomes water by the abstraction of the heat that goes to heat the metal of the cylinder. The steam before cut-off will have a pressure of say 120 pounds, the temperature due to that being 341° Fah. During expansion, the steam loses heat by doing work, adding more water to the cylinder in addition to that formed at the beginning of the stroke. By the time the release period is reached, the steam has fallen to say 60 pounds pressure, with a temperature of 292° Fah. As the water formed at the beginning of the stroke had a temperature about 50° higher than the steam at the end of the stroke, the water flashes into steam under release of pressure, obeying a well-known natural law. With a simple engine this redeemed steam goes out through the exhaust pipe, but with a compound engine it goes into the low pressure cylinder to perform work.

We are not advocates of the compound locomotive, but we are advocates of railroad mechanical engineers trying any improvement that promises to effect material saving of coal. For years we have been advocating the application of a valve gear that would enable the steam to be expanded while doing heavy work. Many attempts have been made to design and apply a valve gear that would permit the steam to be admitted quickly, cut off early and released late, and inventions for this purpose have been put in service that are as nearly perfect mechanically as anything is ever likely to be; yet there is no evidence that the results are economically superior to those obtained from a good link motion. This is what leads us to say, let some enterprising railroad company demonstrate by experiments what there is in the compound locomotive. The subject is, however, well worthy of discussion, and we should like to receive the views upon it of others interested in improving the locomotive.

The Baltimore & Ohio Holocaust.

That supremely horrible form of dual railroad accident, a destructive butting collision followed by the wreck taking fire and burning up a crowd of imprisoned human beings, occurred at Republic, O., on the Baltimore & Ohio Railroad, early in the morning of January 4. The facts of the case as recorded by the Coroner's inquiry make it hard for the public to determine which is the most blameworthy, the criminal carelessness and stupidity of the men immediately responsible for the catastrophe; or the mismanagement of the officers running the road, which prepared the way for the accident and rendered the results more appalling when the trains came together.

The collision happened at Republic, a small way station 255 miles east of Chicago, between a west bound passenger express train and an east bound freight train. The passenger train was not marked to stop at Republic. It had the right to the road, and by the rules of the company the freight train was required to be in the side-track ten minutes before a passenger train was due. The freight train, in charge of conductor Fletcher and engineer Kiler, was working over the division behind time, avoiding regular trains. The engine which Kiler had was evidently worn out, she was reputed to steam badly and his assistant as fireman was a young man with scarcely any experience in the difficult duty he was placed upon the engine to perform, since he had been working as a farm hand only three weeks before. The night was intensely cold, making the train hard to pull, and Kiler had been bracing his nerves during the early portion of the trip by sundry drinks of whisky, and was reported to have been in the habit of stimulating himself in that way when on duty. The freight train stopped at a side track between four and five miles from Republic to let a following passenger train pass, and when they were ready to pull out again the trainmen understood that they had forty-five minutes to make Republic before the west bound passenger train, No. 5, was due. This ought to have been ample time, but the track is an ascending grade, and the train had no sooner started than the steam kept gradually falling and the speed decreasing. The engineer appears to have lounged on his seat, probably napping, and paying no attention to time or to the difficulties of his inexperienced fireman, the head brakeman dozed on the fireman's seat, and the conductor remained heedless in his caboose till the meeting train was dangerously near due. Then he climbed forward over the cars to find the engine at the stalling point for want of steam, and the reflection of the approaching train's headlight in sight. The passenger train was a little late, and was making up time, so that it was running about sixty miles an hour when the engine rounded a curve at Republic, and was fronted by the freight engine's headlight some two thousand feet in front. The engineer of the passenger train did not appear to see the freight engine's headlight or the hand lamp which the conductor had run out waving for some seconds after passing the point where they were visible, for he was within about one thousand feet of the obstruction before he shut off steam and applied his air-brake. After seeing the headlight the engineer of the passenger train acted promptly enough in applying the air-brake and reversing the engine, but his train was equipped with the Baltimore & Ohio straight air-brake, which is slow in action, so that two or three precious seconds were probably lost at the supreme moment, which means the difference between life and death. The passenger train crashed into the stalled engine with such force that the baggage, express and smoking cars were telescoped into an inextricable mass, which instantly took fire from the weak cast iron stoves used by the company, making a funeral pyre for some fifteen or twenty human beings.

The particulars testified to at the inquest leave no manner of excuse for the engineer or conductor of the freight train. According to the accepted state of a man when he is called drunk, Kiler was not in that condition, but he was undoubtedly suffering from the stupor or dulled faculties that proceeds from the use of alcohol, and which unfit a man for occupying a position of responsibility such as every locomotive engineer holds. The stupidity or carelessness of the engineer did not, however, relieve the conductor of his responsibility for the accident. He was aware that the engineer had a bad steaming engine and a green fireman, and his judgment ought to have told him that these circumstances were likely to detract the engineer's mind away from the margin of time left for meeting the passenger train. He tried to excuse himself by saying that it took him so long to pass over the cars that he could not reach the engineer any sooner to stop him. That excuse may help the conductor with a jury, but every railroad man knows that he had an easy means at hand of stopping the train by setting the brakes. It appears to be considered all right on the Baltimore & Ohio to take men from a farm and send them out on a locomotive as fireman, without any previous training, but it is dangerous practice, which in this case has brought a heavy harvest of disaster.

It is certain that, had the engineer of the passenger train been keeping a close lookout ahead, he would have seen the headlight of the freight train when he was over two thousand feet away. All the testimony goes to show that he perceived the danger and applied the brake when he was about one thousand feet from the point of collision. After applying the brake and reversing his engine he jumped off at a point three hundred feet from where the engines came together, yet the passenger train must have been running some twenty or twenty-five miles an hour when the accident happened. All this goes to show that the secondary cause of the accident was an inferior brake. Had the engine and cars been equipped with the Westinghouse automatic brake, used on all first-class roads, there is every reason to believe that there would have been no accident. All the conditions were good for making a quick stop, and hundreds of cases might be given of trains running at as high a speed as that attributed to the Baltimore & Ohio train, and yet being stopped within less space than one thousand feet. Another iniquitous feature about the straight air brake is, that it becomes inoperative at times when unyielding action is essential for preserving life. In a collision there are always two great shocks, the first when the bodies strike, the second when yielding ceases. The violence of the latter shock depends very much on the hold the brakes maintain on the cars. At the moment the first shock takes place and an air pipe or connection is broken, a non-automatic brake, such as that used by the Baltimore & Ohio road, permits every brake on the train to release the hold on the wheels, and the cars strike the second blow with unrestrained force. With an automatic brake, on the contrary, every wheel is grasped with the vise like grip of shoes that continue to hold if every car in the train be wrenched asunder, and the hind cars are prevented from crushing those in front.

Directly and indirectly, the management of the Baltimore & Ohio incur a terrible responsibility for the horrible deaths in the Republic calamity. The engineer of the freight engine was reported to be a drinking man, and a drinking man makes a dangerous engineer. He was provided with incompetent help to operate a worn-out engine at a season when the best trained men have hard work to get trains along. When a collision was imminent an antiquated brake made it certain, and aggravated the violence of the crash; and the weakest and most dangerous kind of heating appliances turned the wreck into a holocaust.

How can Freight Traffic be made More Remunerative?

It is manifest that a favorable solution of this problem can only be reached by the establishment of better rates, or by increasing the average mileage of freight cars and reducing the cost of repairs. Leaving the matter of higher rates out of the account, the chief obstacle in the way of a larger mileage and lighter repairs seems to be due to the present unsatisfactory condition of interchange traffic, the handling of which becomes more difficult and complicated as its volume increases. When a code o interchange rules was first proposed ten years ago it was supposed that such rules could be framed and periodically revised so as to be acceptable to all the roads. This expectation has, to a considerable extent, been realized, but as the interchange increases it has been found more difficult to adapt the rules to every case of disagreement arising under such an extended and intricate system. New revisions are constantly called for to meet new complications. Adherence to the rules being voluntary, there is no way to enforce their observance but by the refusal by one road to receive the cars of anothe rroad that will not abide by the rules.

The cause of the trouble which is now the subject of so much discussion in the local railway clubs, is not so much the imperfection of the existing rules as the general bad condition of interchange cars, a condition that has gradually been growing worse, with no immediate prospect of a change for the better. The percentage of disabled cars of this class is probably greater than ever before, and it may be said without exaggeration that if the rules of interchange as they now stand were rigidly enforced, not more than ten per cent. of such cars would pass inspection at interchange points. Twenty years ago, when a general interchange first began to be a necessity, the general condition of cars was very much better than it is now.

The cause of the deterioration is no mystery, but is to be found almost necessarily in the interests involved in the interchange. No road is going to concern itself very greatly about keeping another road's car equipment in good repair, and until the golden rule of fair and reciprocal give and take obtains wider recognition in railroad practice, there will be a conflict of interest and no end of disputed claims.

The aggregate of freight cars in service on all the roads, according to current estimates, is rapidly approaching a million, including all sorts, and the car shops are overrun with orders for new construction to meet the pressing demand for transportation. It does not follow, however, that there are not cars enough to do all the work and a great deal more, if they could be used to the full extent of their capacity. Railroad companies are compelled to keep a vast number of cars ready for immediate service for which only temporary employment can at times be obtained. The business of all the roads in the country, if it were possible to concentrate it, could be done with one-half, or perhaps even less, of the whole number of cars the companies now have, a large percentage of which during portions of the year stand idle on side tracks as dead stock, while another percentage, which can only be guessed at, is scattered all over the continent and beyond the control of the owners. The cars that are away from home roads are, of course, not cared for in the matter of repairs, and the side-tracked ones at home, however much they may need it, are not put in order so as to be in readiness for service when the rush comes; not in every case because the need is not apparent to the managers, but because the money is not in hand to defray the expense. So the cars stand and wait, and when the time comes are put to work in a dilapidated condition, to become the sooner disabled and side-tracked again. It is useless to talk of increasing the average mileage of cars under such conditions.

What, then, can be done to increase freight earnings and prevent the aggregate number of freight cars from reaching a figure out of proportion to the total track mileage and volume of traffic? One theory is to increase the speed of trains to an average of 25 miles an hour for ordinary freight, and 30 or 40 miles an hour for fast freight, including stops. This, however, can not be done by merely changing the time schedules. Certain requisites of a far more important nature are indispensable, involving large expenditure in various ways. Roadbeds must be looked after, light rails must give place to heavier ones, grades must be lessened by deepening cuts and raising fills, and curves must be straightened by cut-offs. The present standard of freight equipment, which is becoming lowered by loose inspection and other practices growing out of the interchange system, must be elevated correspondingly with the proposed increase of speed, or to something analogous to the standard of passenger equipment. How, it may be asked, would the freight car truck of the period—the proposed perfected standard that has just been subjected to letter-ballot—work in limited express trains? Through freight can not be moved at passenger speed so as to make the cars do more work and double their mileage, unless the conditions inseparable from such movement are complied with.

We scarcely need refer to the great need of a more effective accounting system to prevent the abuses now practiced in the use of lost cars. Such a system is certainly practicable, but whether the advantages to be derived from it would warrant the expenditure seems to be a mooted question.

Electric Street Car Motors.

The street railway surface lines, now operated almost universally by horses, are a most inviting field for the practical application of electricity as a motor. If this new agent is destined sooner or later to displace any of the existing systems of mechanical locomotion, its first inroads must be made upon street lines where a more effective power is sorely needed to take the place of animal muscle. When electricity begins in a thoroughly practical way to get the better of horseflesh upon our great city thoroughfares, it will then be in order to see what it can do upon steam and elevated roads. The use of horses for propelling vehicles is as ancient as the hills, but in spite of the antiquity of this method it has thus far held its own against steam and every other substitute that has been proposed for transporting the vast and rapidly increasing multitudes of people upon street surface lines. No end of experiments have been made with steam, compressed air and other sources of power, without dispensing with horses to any appreciable extent. The cable systems, it is true, have made some headway, but their progress is slow, and is doubtless retarded to some extent by the promising but undeveloped possibilities of electricity.

A record of all the electric railways that are now reported to be in successful operation in Europe and in this country would make quite a formidable showing, to say nothing of the numerous and partially successful attempts in the same direction that have been made within the past few years. If full credence were given to the many glowing announcements that have been heralded in the newspapers from time to time, no other conclusion could be reached than that the use of horse power for propelling street cars was rapidly nearing its end.

The electric railways that are reported to be in actual operation, as well as those in course of construction, are all short lines of two or three miles, but long enough for experimental purposes. There is one in Baltimore with two Daft motors which are said to take the place of thirty horses, the line having maximum grades of 330 feet to the mile, and curves of 70 feet radius. Several trials of the same system have also been made on the Ninth avenue line in New York, but with no marked success. The Bentley-Knight electric railway has had a prolonged trial in Cleveland, and the Frankfort-Offenbach system is soon to go into "regular operation" at South Bend, Ind. At Scranton, Pa., a line two miles long has been completed, with steep grades and an electric motor "easily controlled and most effective." A new line is also in progress at Detroit, and two new lines at Pittsburgh. Experiments are also being made in Philadelphia, San Francisco and elsewhere.

Aside from the mechanical defects in the various methods of applying the electric current in the movement of street cars, there is a tantalizing lack of definite information in respect to the cost of these methods as compared with that of horse power, and it is not surprising, therefore, that a good deal of skepticism should prevail in regard to the ultimate success of any of the plans that have thus far been tried. Fifty years of steam locomotion have been necessary to develop the modern locomotive, the early prototypes of which were crude in construction and performance; and it is fair to assume that electric motors will have to pass through similar stages of progress, and overcome even greater obstacles before reaching the goal of success. The system of elevated roads in New York City, with their enormous and growing traffic, can not be used to any great extent for testing experimental systems without considerable hazard and inconvenience. And, furthermore, there is at present a great divergence of opinion among mechanical experts as to which of the rival electrical systems is the best. It would, therefore, be hasty to conclude that these systems and their enthusiastic promoters will finally be forced to retire and leave the field in the undisputed possession of steam and horses.

The Proposed Standard Freight Car Truck not Adopted.

We print elsewhere the result of the letter-ballot on the adoption of the plans and details for a standard truck for freight cars of 40,000 pounds capacity, as reported by the committee on the subject at the last meeting of the Master Car-Builders' Association. The 243 affirmative votes, although a majority of 40 of the whole number cast, were 28 less than the requisite two-thirds, and consequently the truck was not adopted. This result will not cause much surprise among railroad men who have watched the efforts of the association during the past three years to perfect and agree upon a standard, and it is now more uncertain than ever whether such agreement will very speedily be reached.

At the annual meeting in June, 1885, the committee on the subject presented, in accordance with instructions, a plan for a diamond truck to be used either with a swing or rigid bolster, with a recommendation that a number of trucks be built on the proposed plan and put in service. The Michigan Central and the Chicago, Burlington & Quincy roads built such trucks, and they were exhibited at the Niagara meeting of the association in June, 1886. The committee at the same meeting recommended, with some slight modifications, the plans and details as embodied in these trucks to be adopted as a standard, the general construction being substantially what had been recommended the previous year under instructions to the committee. The association now practically refuses by letter-ballot to abide by its instructions, and it remains to be seen what further action will be taken at the annual meeting next June.

In the meantime the roads, under the pressure of increasing traffic, are building trucks to suit themselves as regards capacity and details, thus drifting further and further from any general standard that is likely to be approved by the Car-Builders' Association. Some want a standard truck to carry 60,000 pounds, and some of the roads have built such trucks and are likely to build more. Some can not see the need of a standard limited to 40,000 pounds unless the construction is such that it can be expanded to a larger capacity, while others insist that only certain parts and dimensions need to be standard in order to be interchangeable.

We have heretofore contended that under the voluntary system which leaves each road to be a law unto itself in the matter of equipment, regardless of what other roads do, there can be no standard trucks, strictly speaking, except local ones. Such a thing as a freight car truck that will be practically a universal standard common to all roads being out of the question, it would seem that a certain number of roads—the more the better—might unite in adhering to one prescribed construction, and thus secure to a proportionate extent approximate uniformity, which is all that is aimed at. Instead of waiting for new modifications and more letter-ballots, involving delay and uncertainty, let the roads represented by the 243 votes in favor of the proposed truck of 40,000 pounds capacity adhere to it as a standard if they like it. This they can do now just as well as they could have done it had there been 28 votes more in its favor, or just enough to make two-thirds. Such a course might perhaps savor a little of insubordination to the association, but the voluntary system is paramount in either case, and the evils of diversity are obviated just to the extent that the companies agree, and live up to their agreement, to use the same thing.

It may be that the tendency to carry heavier loads is getting to be so strong that by another year a great many railroad men will consider it inexpedient to have a standard truck of this capacity. It should be borne in mind, however, that the nominal capacity of freight cars nowadays is not their maximum capacity. We do not know just how much the sample trucks built and put in service by the Michigan Central and C. B. & Q. roads were equal to, but it is reasonable to suppose they would stand a good deal of overloading.

Car Heating by Steam.

The objection is made by the NATIONAL CAR AND LOCOMOTIVE BUILDER that the steam taken for warming would cripple the locomotive in the coldest weather, when the demand both for speed and heat would be the greatest. But Conductor French and Engineer Munyan, on whose trains the steam heat has been longest in use, say that they have never had trouble of this sort, and both indorse the steam heating as eminently successful, always practicable, comfortable and pleasant. President Leonard and Superintendent Mulligan also indorse the method, saying that it is as successful as any experiment of its age could be expected to be. Mr. Mulligan says that with a lighter engine than Munyan's, with four cars, there is occasionally a little trouble to get steam enough for both heat and motive power. The cost is not greater than in heating by stoves. President Leonard says that the public demand is for a method of warming which shall have no fire about the cars, and he thinks that Emerson's invention, *with the supplementary furnace and boiler, ready to be lighted at a moment's notice*, meets the demand very well. He does not think, however, that the regular use of a fire underneath the car is more desirable than the Baker hot-water heat or than other methods of warming. Other employés of the road, notably Robert Hitchcock, foreman of the car shops, indorse the steam heat heartily, and passengers who travel daily up and down the road warmly praise its comfort and evenness. The importance of the subject is indicated by the fact that a petition, requesting the Legislature to consider the expediency of compelling railway companies to warm and light their cars by safer methods than those now employed, is being extensively signed in some of the eastern Massachusetts cities.

The above cutting is from a long article published in the Springfield *Republican* on the heating of cars on the Connecticut River Railroad by steam from the locomotives by the Emerson system of car heating. This is just the kind of train service that the article referred to in the NATIONAL CAR AND LOCOMOTIVE BUILDER insisted that heating by steam from the locomotive was adapted for. We acknowledge that the subject of heating cars safely is very important, but we do not think public safety will be improved by panic legislation. Movements of this kind are too often of an ax-grinding nature. There are other methods of car heating just as safe as heating by steam, and nearly all enterprising railroad companies are adopting the methods they find the most practicable substitutes for the dangerous cast-iron stove. If steam heating has merits that make it superior to other methods, there is no fear but it will receive liberal patronage from railroad companies. Having already stated the objections we see to the general introduction of steam heating for railroad cars, we are, nevertheless, unwilling to appear unfair toward the system. Desiring to obtain information direct from the responsible officers of a road heating their cars by steam from the locomotive, we recently wrote Mr. Mulligan, superintendent of the Conneticut River Railroad, asking questions about their experience with cars heated in this way. In the course of a very full reply, he says:

"We have used the Emerson system of heating cars with steam direct from the locomotive on our short trains, averaging three cars, for the past two years with very satisfactory results, the cars being kept at a temperature of not less than 60° Fahr. at any time while on the road. We have never tried the system on a long train, as these trains are made up of cars coming from and going to our northern connections, and we have not yet deemed it advisable to ask these connecting roads, *i. e.* the Central Vermont and Passumsic roads, to apply the necessary apparatus to their motive power, as would be necessary in order to heat the cars by this system the entire distance the cars run, viz., between Springfield, Mass., and St. Albans, Vt., and Springfield and Sherbrooke, Can. I have no doubt with proper apparatus the system will work as well on a long train as it has on short trains."

Locomotives and Locomotive Building in America.

Under the above title the Rogers Locomotive Works, Paterson, N. J., have issued a most attractive and interesting catalogue or hand-book. It is very appropriate that a book describing the kind of locomotives built by the Rogers Locomotive Works should trace the history of this form of engine, for to describe the work done in the Paterson shops at different periods of their history is to portray the growth and development of the locomotive. Thomas Rogers, the founder of the works, was among the first mechanics in America who undertook to build a locomotive, and he did as much as any one man to develop the machine and settle the admirable form that now constitutes par excellence the American locomotive. Although Mr. Rogers did not build the first American locomotive, he did work for the first American railroad, and was one of the far seeing men capable of perceiving the great future for railroads as a means of land transport.

The first locomotive built by the works of Roger, Ketchum & Grosvenor, as the firm was originally called, was finished in 1837. It was a six-wheel engine with inside cylinders 11 × 16 inches. The forward end of the engine was carried by a four-wheel truck, and a single pair of drivers 54 inches diameter set ahead of the

fire-box carried the hind end of the engine. This engine had one of the improvements put by Rogers on the locomotive early in its history—the driving wheels were made of cast iron with hollow spokes and rims, the type that was afterwards adopted by all our makers. This style of wheel proved so satisfactory that Mr. Rogers shortly afterwards added an improvement in the shape of a solid portion opposite the crank for the purpose of counter-balancing the weight of crank and connecting rods. This was patented as a protection, but other makers were not prevented from using the device. The use of a good means of counter-balancing led the way to the use of outside-connected locomotives. Nearly all early locomotives were made with cranked axles and inside cylinders in imitation of the engines built by Stephenson & Son and other British builders, there being an impression that engines with outside cylinders would run unsteady, strain their frames and be harder on the track than those that were inside connected. Before a locomotive had been ten years at work on an American railroad, the mechanical difficulties connected with the crank axle began to be recognized. Some builders went in for improving the crank axle, but by the time he was five years engaged in building locomotives Rogers concluded that the the most certain way to prevent accidents by crank axles breaking was to abandon altogether the bad form which can never be made reliable.

In 1842 the works built an engine with outside cylinders. The advantages of that style soon became recognized, and the demand for inside-connected engines decreased gradually till the building of them ceased altogether. While the inside-connected style of locomotive was still popular, Mr. Rogers put the steam chests on the outside, arranging them so that the values could be reached from the top, an improvement that considerably reduced the expense of repairs. Being a good mechanic, with excellent inventive abilities, and having the peculiarly American desire to make machines that would be easily repaired, Mr. Rogers introduced a great many minor improvements and conveniences that did much to make his build of engines popular.

The early class of master mechanics, locomotive designers and inventors, devoted great attention to perfecting the valve gear, and the desire to effect economy of steam appears to have influenced most of their efforts. From the year 1835 to 1850 a great many different forms of valve motion were designed, and not a few were applied to locomotives; but the designers, as a rule, overlooked the fact that the first consideration in designing parts for a machine subjected to the hard usage and complex strains that have to be endured by a locomotive, is simplicity. Many motions were produced that were calculated to give an excellent distribution of steam, but the cost of maintaining the mechanism in order overwhelmed any saving that might accrue from economy of steam. When the railroad mechanical world was getting to realize that complex valve gear that was capable of saving some wood was too expensive in other respects, the link motion appeared. There is little doubt that a form of link motion had been invented by Mr. William T. James, of New York, in connection with a traction engine about 1830, but the engine was destroyed by the boiler bursting, and the invention was lost until it was reproduced by Mr. William Howe, of Newcastle, England, in 1842. Howe worked in the Stephenson locomotive works, and his invention was applied to locomotives built there, which led to its being known in this country as the Stephenson link. When this device was offered to American master mechanics as a valve gear, strong objections were raised against it. These men understood the functions of valve gear, and quickly perceived the defects of the link motion. Thomas Rogers could see the shortcomings of the link as a means of distributing steam, but he also recognized the merits of the link motion as a piece of mechanism. On this ground he began advocating the use of the device, and his influence did much in rapidly introducing the link motion upon American locomotives. We have been informed that with the help of Mr. William S. Hudson, Mr. Rogers originally discovered that by hanging the link behind or above its center the cut off could be equalized.

The catalogue, which is beautifully illustrated, consists of ten chapters, covering 193 pages 8×5 inches. The titles of the chapters give an idea of what they contain. There are: The origin of the Rogers Locomotive and Machine Works; The early history of railroads in this country; The early history of locomotives in this country; History of Locomotive Building at the Rogers Locomotive and Machine Works; The organic development of the locomotive, the boiler, the engines, the running gear; The Rogers Locomotive and Machine Works in 1886; A remarkable run of 426 miles by Rogers locomotives on the N. Y., W. S. & B. Railway; The tractive power of locomotives; Plates and tables of dimensions and capacity of locomotives of 4' 8½" gauge or wider; Plates and tables of and dimensions and capacity of narrow-gauge locomotives.

The compilation of the catalogue was done by Mr. M. N. Forney, and is a highly creditable performance.

Sight-Feed Lubricator Patent.

The suit of the Detroit Lubricator Company against Frederick Lunkenheimer, of Cincinnati, for infringement of the Flower sight-feed lubricator patent, which has been pending in the United States Circuit Court at Detroit for nearly two years past, was brought to a final decision in favor of the defendant on Friday, Jan. 14, 1887. In the early stages of the suit the complainant was successful; the patent was held invalid and the defendant enjoined; but soon afterward the defendant discovered evidence which rendered the validity of the patent doubtful, and upon application to the court the case was reopened and leave given to take the newly discovered evidence. The case came on for a re-hearing upon such evidence, and Judge Brown, who had rendered the former decision, held the evidence to show that Flower was not the first original inventor of the device claimed, and also that the invention had been in public use in this country for more than two years prior to his application for the patent, and for both reasons declared the patent to be invalid and void. On Friday, Jan. 14, the complainant was granted a re-argument of the case upon its merits before Judge Jackson, the United States Circuit judge, and Judges Brown and Severens, United States District judges, at the conclusion of which the former decision of Judge Brown was unanimously and emphatically sustained, and the patent again and finally declared void.

The counsel in the case were Wells W. Leggett and Geo. H. Lothrop, of Detroit, and Judge Hodges, of New York, for complainant, and Peck & Rector, of Cincinnati, for defendant.

Baldwin's Output of 1886.

In answer to a letter of inquiry, Messrs. Burnham, Parry, Williams & Co. write us:

Our aggregate product for the year ending the Dec. 31, will be 544 locomotives. This number comprises 93 switching engines, 135 American type locomotives, 143 mogul locomotives, 61 ten-wheel locomotives, 60 consolidation locomotives, 2 decapob locomotives, and 50 locomotives of various types. Among the whole, eight are of peculiar construction. These are: 4 soda motors, with two pairs of driving wheels and a two-wheeled trailing truck, built for the Minneapolis, Lyndale & Minnetonka Railway.

Two decapods: These were built for the Northern Pacific Railroad to operate the Cascade division of that line. They have five pairs of driving wheels 45 inches diameter, connected as driving wheels, and a leading two-wheeled truck. The boilers are of steel 68 inches diameter straight. Heating surface of fire-box, 162 square feet, of flues, 5,148 square feet. Weight of locomotive in working order on driving wheels, 134,000 pounds, total 148,000 pounds. Weight of tender, 3,600 gallons capacity, 82,000 pounds. Weight of locomotive and tender, 230,000 pounds. The driving wheel base is 17 feet, total 24 feet 4 inches. Total wheel base of engine and tender, 49 feet 2 inches.

Autofogasta Railway, of Chili: This locomotive, although only of 30-inch gauge, is designed to attain the speed of 35 to 40 miles an hour. To insure safety when running at these speeds, and to get the greatest possible width of base, the frames are placed outside of the driving wheels. At each end is a two-wheeled truck, the front side-bearing and the rear center-bearing, to give the engine a long and flexible wheel base. Its general dimensions are: Gauge, 30 inches; cylinders, 13 × 20 inches; driving wheels, 48 inches diameter; boiler, 42 inches diameter. This engine is fitted with the Le Chatelier brake.

Franklin & Megantic Railroad: This is a Forney engine of only 2 feet gauge; cylinders, 9 × 14 inches; driving wheels, 30 inches diameter. Fitted with Eames vacuum brake.

Pan Handle Locomotives.

From Mr. E. B. Wall, superintendent of motive power of the Pittsburgh, Cincinnati & St. Louis, we have received the following particulars respecting the additions made to their stock of motive power during last year. Engines, 27 in all, as follows:

2	Class	N	for	Little Miami,	built	at	Altoona.
4	"	"	"	1st. Div.	"	"	"
3	"	S	"	P., C. & St. L.,	"	"	"
7	"	"	"	" "	"	"	Ft. Wayne.
2	"	"	"	1st. Div.	"	"	"
2	"	I	"	P., C. & St. L.,	"	"	"
4	"	M	"	" "	"	"	Alleghany.
1	"	"	"	1st. Div.	"	"	"
2	"	E H	"	2d. Div.	"	"	Logansport.

The class S is a modification of the I, and is intended to be used when the present heaviest type of P. R. R. freight engine (class R) cannot be run. It has a straight boiler instead of a slope sheet, as in the I. It has crown-bars, straight flue sheet, and 2¼ inch flues; the I has a Belpaire fire-box, with combustion chamber and 2¼ inch flues. The I also has bushed side-rods and the Ross steel brake rubbers. The E H engine is a type of shifter that we have used to a considerable extent where the class M, the heaviest type of switcher, would be too heavy. The E H is heavier than the H.

Canadian Pacific New Locomotives.

From Mr. Francis R. F. Brown, mechanical superintendent of the Canadian Pacific Railway, we learn that a great deal of work was done in the shops belonging to the road during the past year. In the Montreal shops 25 new locomotives were built, of the following types: 4 consolidation engines with cylinders 19 × 22 inches; driving wheels, 51 inches; boiler pressure, 160 pounds; weight in working order, 104,000 pounds. These engines are fitted with the extension front and straight stack, Westinghouse air brake on one pair of drivers, tender and for train, American steam brake on the second pair of drivers. The tender capacity is 3,000 gallons imperial, or over 3,600 standard gallons, the unusually large tank capacity being intended to provide for the regions where long runs must be made between water stations.

They built 3 of the heavy standard passenger engines, cylinders 19 × 22 inches; driving wheels, 69 inches: boiler pressure, 160 pounds; weight in working order, 98,000 pounds; tender capacity, 2,800 imperial gallons. These engines are fitted with Westinghouse air brake on driving wheels, tender and for train.

In the line of comparatively light passenger engines, 8 were built with cylinders 17 × 24 inches; driving wheels, 69 inches; weight in working order, 89,000 pounds; tender capacity, 2,800 imperial gallons. These engines have Westinghouse air brake for drivers, tender wheels and for train. The boiler pressure is 150 pounds.

Five road engines, with cylinders 17 × 24 inches; driving wheels, 62 inches diameter; boiler pressure, 150 pounds: tender capacity, 2,800 imperial gallons. These engines have Westinghouse air brake for train service, and the American steam brake for drivers and tender; weight in working order 85,000 pounds, There are also five more road engines similar to the above, but slightly lighter and without the steam brake.

New Railroad Mileage in 1886.

Under date of Jan. 13, Messrs. Poor & Greenough issued a circular in which the following statement of new mileage constructed in 1886 is given by H. V. & H. W. Poor, the well known compilers of Poor's Manual:

New England	41.00
Middle States	374.48
Central Northern	1,231.61
South Atlantic	1,018.93
Mississippi Valley	339.50
Southwest	2,427.11
Northwest	2,578.18
Pacific Coast	637.95
Total	8,648.76

Omaha Railway Club Organized.

Pursuant to invitation, a number of the employés of the Union Pacific Railway Company met at the office of Mr. C. N. Pratt, Storekeeper, on Saturday, Jan. 15, at 4 o'clock p. m., for the purpose of taking steps to organize a railway club, the object being the intellectual improvement of the members in matters pertaining to railway service. The meeting was called to order by Mr. G. T. Crandell, who nominated Mr. John Wilson as chairman. Mr. Wilson, on taking the chair, stated the objects of the proposed club, the benefits to be derived from it, and hoped that it would be a permanent organization. Mr. G. T. Crandell was chosen secretary. An informal discussion followed regarding the permanent organization of the club and suitable rooms for its meetings. A motion was made and carried that the chair appoint a committee to procure copies of by-laws and constitution governing similar clubs, and to draft a set to be submitted at the next meeting. On motion, the number of the committee was increased to five, and Messrs. Crandell, Pratt, Litchterberg, Munford, and Ledley were appointed such committee. Motion was made and carried that the next meeting be held on the first Saturday in February, at the same time and place.

New York City Passenger Travel.

The reports made to the Railroad Commission for the year ending Sept. 30 last give the number of passengers carried on the city lines as follows:

	1885-86.		1884-85.	
	Number.	P.c.	Number.	P.c.
Elevated lines, 4	115,109,591	35.4	103,702,729	35.2
Surface lines, 17	210,032,484	64.6	191,319,523	64.8
Total	325,142,075	100.0	295,021,256	100.0

The total increase was 30,120,819, or 10.2 per cent. The reduction of fare to 5 cents was in effect on two of the elevated lines for part of the year; the reduction on the two most used lines did not take effect until after the close of the year. It will be seen that the surface (horse) lines still continue to carry the larger part of the passengers. The total movement last year was equivalent to the transportation of 445,400 passengers daily in each direction.

The Proposed Standard Freight Car Truck Not Adopted.

Mr. M. N. Forney, Secretary of the Master Car Builders' Association, has issued the following announcement:

In response to the circular dated Oct. 20, 1886, which was sent to the members of the Association, there were 243 votes cast in favor of the adoption, as a standard, of the plans for trucks of freight cars of 40,000 pounds capacity, submitted with the circular, and 163 votes against their adoption. As two-thirds of all the votes cast are required for the adoption of standards, the proposed plans for trucks have *not* been adopted.

Brake Committee Meeting.

MR. G. W. RHODES, Chairman of the Committee, issues the following circular, under date of Jan. 7:

"A joint meeting of the M. C. B. Brake Committee and the representatives of brake companies intending to participate in the April, 1887, tests, will be held at Pittsburgh at 10 o'clock A. M., Wednesday, Feb. 9, at the Hotel Anderson.

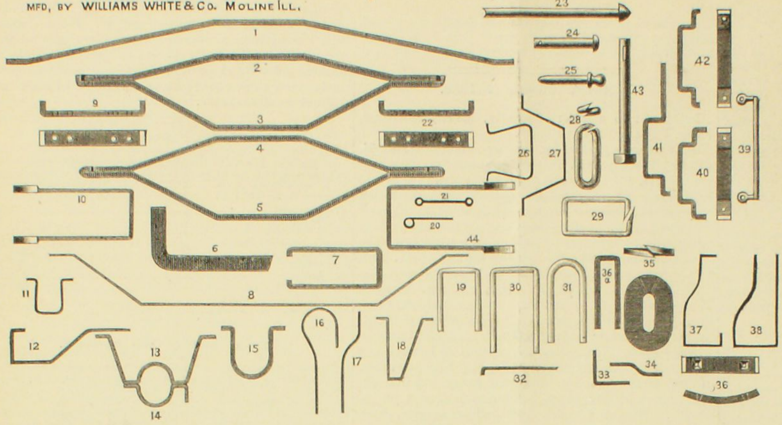
"The rules governing the tests will be decided on at this meeting. A full attendance is requested."

THE Union Switch & Signal Co., of Pittsburgh, has bought the patent rights, material and good will of the interlocking signal business hitherto carried on by the Pennsylvania Steel Co., of Steelton, Pa. The latter company has transferred to the former all existing contracts relating to the interlocking of signals, and all special tools and plants used specially for making signals and interlocking apparatus. These contracts will be carried out by the Union Switch & Signal Co. The Pennsylvania Steel Co. will continue as usual the manufacture of frogs, switches and switch-stands, which is not interfered with by this arrangement. The Union Switch & Signal Co. is transferring the works in Pittsburgh to the Westinghouse Electric Light Co., and has taken the premises of the old Swissvale Car Works, just outside the city limits of Pittsburgh.

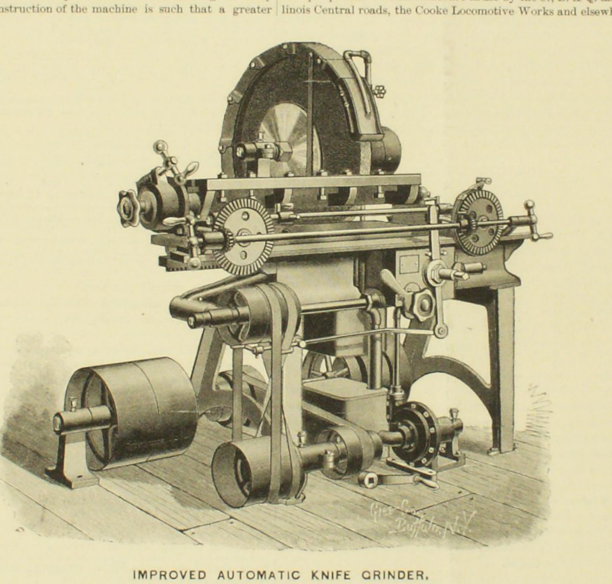
THE PEERLESS MANUFACTURING CO., of Louisville, Ky., report that the growth of their business has compelled them to enlarge their molding department. In order to utilize their Rice Sand Molding Machines, they will so go into the manufacture of grates and fire-place settings, for which their plant is very complete. Their patterns and designs are new and very attractive. Photographs and descriptions furnished on application.

THE PROSPECT MACHINE & ENGINE CO., of Cleveland, O., have just completed for the Lowell Carpet Co., of Lowell, Mass., the largest pair of engines ever built in the West. The engines are coupled, run 81 revolutions per minute and have 48-inch stroke. The main cylinders are 39 inches in diameter, the crank shaft has a total length of 22 ft. 10 in., diameter 20 in. and weighs 11 tons. The fly-wheel is 20 ft. in diameter, and carries three belts, two 40 in. wide and one 36 in. The engines were built under the supervision of Mr. Alfred Clark, and will develope about 3,000 horse-power.

SAMPLES OF R.R. IRONS FORMED IN A BENDING MACHINE. RUNNING 7 STROKES PER MINUTE, MFD. BY WILLIAMS WHITE & Co. MOLINE ILL.



The above cuts represent some of the shapes of freight car irons forged by pressure in a machine manufactured by Williams, White & Co., at Moline, Ill. This machine does the forming, forging and bending by a more gradual pressure, as compared with the sudden blow of the drop hammer, thus giving the particles of metal more time to adapt themselves to the changing form, and with less liability to crack in the making of sharp bends. The construction of the machine is such that a greater variety of shapes are produced than in drop press work and also duplicate parts. The dies are also much lighter and more easily attached. The machine is manufactured in four sizes, the largest of which weighs about six tons. Its adaptation to railroad and car work is shown by the shapes illustrated, the forging of the irons of a freight car by this process costing only one-fourth of a cent per pound. The machines are in use by the C., B. & Q. and Illinois Central roads, the Cooke Locomotive Works and elsewhere.



IMPROVED AUTOMATIC KNIFE GRINDER.

The engraving represents an improved knife-grinding machine manufactured by the Springfield Glue & Emery Wheel Co., Springfield, Mass. One of the improvements consists of a centrifugal pump, which is attached to each machine, properly piped with valve to regulate the flow of water on the wheel. The water is taken from the tank located on the floor under the machine and out of the way, and after being used runs into a second tank just under the wheel, where the sediment settles and comparatively clean water overflows from the top of this tank into the tank and pump below, thus using the water over and over. The tank catching the sediment is easily taken out and emptied. The pump furnishes a large supply of water, prevents heating and drawing the temper, and the grinding, it is said can be done faster than when ground dry. A folding hood nearly surrounds the wheel, which prevents the water from flying, and is adjustable to the wearing away of the wheel.

Improved collars on the spindles of these machines are made to take wheels with holes in them half the diameter of the wheel, and future wheels for the machines will cost less as a consequence. The loose collar is so arranged that the wheel can be balanced at any time, an improvement that is not found in any other make of emery wheel grinders. These machines are strong, well proportioned and thoroughly made, and the working parts are well protected from emery and dust. The worm and worm gear are run in an oil dish to prevent wear. The carriage can be instantly stopped by dropping the worm out of gear without shipping any belts or stopping the wheel, a convenience in putting on and taking off of knives.

It has an automatic cross-feed, by which both ends of the knife are fed up equally at the same time, and can be adjusted so precisely that it will grind one six-thousandth part of an inch at each traverse of the carriage, and as much more as is desired, and it will stop feeding and grinding at any point, so, when properly adjusted and set in motion, no attendant is required, an important saving in itself. There is a graduated dial at the end of the knife bar, so the bar can be quickly set and the knife ground at the same degree or bevel as when previously ground. The knife can be set with edge up or down, to grind to or from the edge. Cone pulleys on feed shafts regulate the carriage to any desired speed. The emery wheel is 26 × 1½ inches, and is hung in a swinging frame, easily adjusted by a forward movement, to the wearing away of the wheel, and cone pulleys increase the speed correspondingly.

Special attachments are furnished on these machines to do a large variety of work. The company guarantees all machinery sent out, and has such confidence in these machines that it will ship them to any responsible parties on trial, and if it does not prove as represented, it will receive it back and pay the freight charges. The company make 55 styles and sizes of emery wheel grinding machinery. Any one wishing anything in this line would do well to write them.

THE CINCINNATI CORRUGATING Co., of Cincinnati, O., have for years used the word "Superior" as their brand, and endeavor to maintain its verity by attention to every minute detail; every sheet of iron being carefully inspected before painting, when even the smallest "pin-hole" compels rejection; by using the most improved machinery, all driven by steam power; by using none but the best metallic paint, thoroughly reground in pure linseed oil; by carrying the largest stocks of sheet iron in the United States, thus filling all orders promptly; by furnishing inquirers at once with detailed estimates.

THE Union Pacific, it is said, has adopted the twenty-four o'clock system, but there seems to be a hitch about putting it in practice. A sort of preliminary trial of the system, reported to have been made at Omaha, caused quite a serious unpleasantness between a station agent and an old lady who wanted to know when the overland train started. On being told, with bland civility, that it would leave at 17:45, she gave the agent a paralyzing look, and walked away nearly paralyzed herself. This is the last we have heard of the practical working of the scheme. In our judgment it will not be a success until the great mass of plain people are more thoroughly educated up to it. It may do very well for astronomers and almanac makers, but it is too unique and transcendental for every day use. It don't look well on paper even. A system of reckoning time which has been approved and adhered to for ages, the world over, can not be changed quite as easily as a railraad track gauge.

The Goodwin Dump-Car.

A record of the actual service performed by a four-wheel Goodwin dump car in five working days, shows 514 miles traveled (448 loaded and 66 empty), three cargoesdelivered; mileage earned at $\frac{3}{8}$ cent per mile, $1.92, or at the rate of $140 per year, which is more than half the cost of the car; ton mileage, 4,355; freight earnings, $26.13, or 0.6 cent. per ton per mile.

It is estimated that the average tonnage service of all the freight cars in the country is about 207 ton miles per diem, or 1,035 for five days, which is less than one-quarter of the mileage made by the dump-car in the instance cited. The unloading of the three cargoes cost nothing aside from the use of the trestles from which the loads, consisting of mill cinder and coal, were dumped. The car run in regular freight trains, and was handled by train hands exclusively.

DURING the year 1886, the Chicago, Burlington & Quincy and proprietary roads built 14 new locomotives in their own shops. The shops on the Q. system built 5 class G engines, that being the standard switcher, with cylinders 18 × 24 and six pairs of wheels connected. The H. & St. J. built 6 engines of class A, an eight-wheel engine adapted for freight or passenger service. The C. & I. built 3 of this class of engine. In the line of heavy repairs, the C., B. & Q. rebuilt 11 locomotives; the B. & M. R., 6; the H. & St. J., 5, and the K. C., St. J. & C. B., 1. The machinery on the whole system of roads is in first-class condition, and there are very few engines of ancient patterns.

Our Directory.

We note the following changes since our last issue. Our readers will do us a great favor by giving us prompt notice of any changes that may come to their knowledge or of any errors that may be noticed in our list:

Allegheny Valley.—S. B. Rumsey has been appointed Superintendent of the Low Grade Division, vice A. A. Jackson resigned.

Baltimore & Ohio.—Bradford Dunham has resigned the position of General Manager.

Boston & Albany.—E. L. Sackett has been appointed Superintendent of the Springfield Division, in place of C. E. Grover, deceased.

Central, of New Jersey.—This road, with its branches and leased lines, is now operated by the Receivers. The names of the recently appointed officers will be found in our Directory.

Chesapeake, Ohio & Southwestern.—This road is now the Western Division of the Newport News & Mississippi Valley Co.

Chicago & St. Louis.—The name of this road has been changed to "Chicago, Santa Fe & California."

Cleveland, Loraine & Wheeling.—F. M. Townsend has been appointed Purchasing Agent.

East Tennessee, Virginia & Georgia.—J. B. Michael succeeds B. J. Sitton as Master Mechanic of East Tennessee Division; and C. L. Petrikin is Master Mechanic of Alabama Division, in place of J. B. Michael, transferred.

Louisville, New Albany & Chicago.—A. S. Durham has been appointed Purchasing Agent, in place of Geo. W. Stevens, resigned.

Minnesota & Northwestern.—J. H. Eames has been appointed Purchasing Agent.

Montana Union.—J. E. Dawson has been appointed Superintendent, vice Charles Blackwell, resigned.

New York Central Sleeping Car Co.—The name of the company has been changed to "The Wagner Sleeping Car Co."

Philadelphia & Reading.—A. A. McLeod has been appointed General Manager, vice John E. Wootten, resigned.

Texas & Pacific.—A. H. Watts is Master Mechanic of Eastern Division, Marshall, Tex.; J. W. Addis, Master Mechanic of New Orleans Division, Gouldsboro, La.; and A. S. Douglas Master Mechanic of Rio Grande Division, Big Springs, Tex.

Vicksburg & Meridian and Vicksburg, Shreveport & Pacific.—H. F. Clark has been appointed Superintendent of these roads, vice M. S. Belknap, resigned.

Wheeling & Lake Erie.—W. R. Woodford has been appointed Assistant General Manager, and will have charge of the purchase of supplies.

Wisconsin Central Associated Lines.—C. C. McLeod has been appointed Purchasing Agent, vice E. K. Howes, resigned.